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THE NATURAL AND CULTURAL ENVIRONMENTAL RESOURCES OF THE AQUILLA--ETC(U
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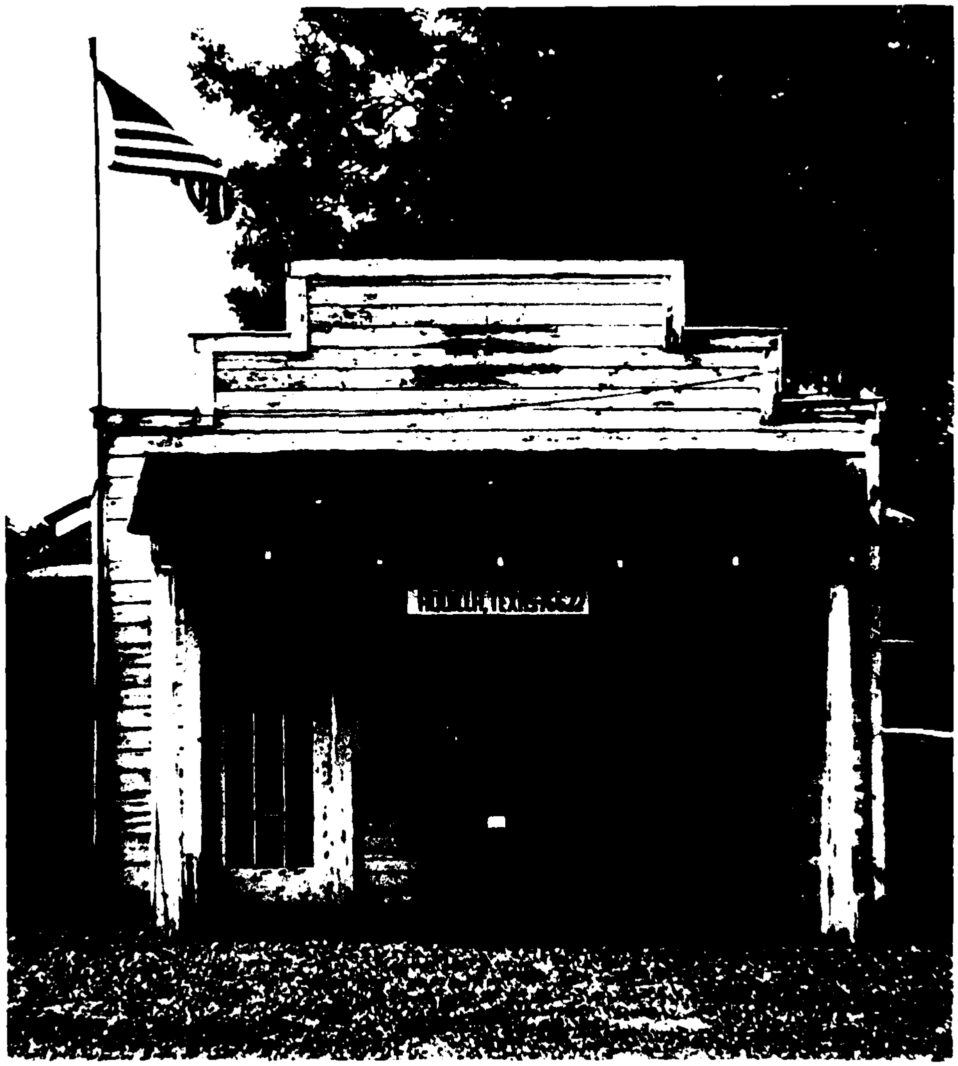
# THE NATURAL AND CULTURAL ENVIRONMENTAL RESOURCES

of the

# AQUILLA CREEK WATERSHED

HILL COUNTY, TEXAS







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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report is a three month study of systematic and intensive field investigations of the Aquilla Creek Watershed. The purpose was to evaluate the cultural resources that includes an archaeological and historical inventory of the area along Aquilla and Hackberry Creeks between State Highway 22 and Aquilla, Texas with regard to the impact of the construction of the proposed lake would have on them. There were one hundred twenty-five prehistoric sites recorded in the area. The rolling hilly terrain makes for environmental variation within a short distance. The report recommends salvage excavations to recover cultural information about prehistoric

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20. occupation of the site before construction of the lake.

# THE NATURAL AND CULTURAL ENVIRONMENTAL RESOURCES

# OF THE

# AQUILLA CREEK WATERSHED

# HILL COUNTY, TEXAS


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Report submitted to the Corps of Engineers, Fort Worth and Tulsa Districts, by the Institute for the Study of Earth and Man, ~~Southern Methodist University, in~~ final fulfillment of Contract DACW 63-72-C-0105, November 1, 1972.

TABLE OF CONTENTS

## LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES

The National Environmental Policy Act of 1969 (Public Law 91-190) has made it mandatory for federal agencies to evaluate the environmental impacts of their projects and programs during the early planning stages. The Aquilla Lake Project was authorized by the U.S. Congress before enactment of Public Law 91-190 but since it had not been completed before that time it is necessary to prepare a detailed Statement of Environmental Impact. This report summarizes the results of a three month systematic study by an interdisciplinary team composed of faculty and students from the Institute for the Study of Earth and Man and the Department of Biology at Southern Methodist University. The purpose of the study was to evaluate the impact upon the natural and cultural environmental resources of the Aquilla Lake Project.

The Aquilla Creek Watershed is typical of many natural areas within this country in that it has received very little attention from scholars because no important resources were reported from its area. Although mentioned by various biologists, geologists, historians, archaeologists, and others no detailed systematic studies of the entire area are known to have been published. Does this mean that important resources are not present? In most cases, the answer would be "Certainly Not!" rather that there was no pressing threat to the loss of the natural resources; therefore, they would be preserved, or time was not available to focus on an area in order to document the resources present. Why researchers from Baylor University, Hill Junior College, Southern Methodist University, McLennan Community College, Texas Christian University or the University of Texas at Arlington had not previously studied the Aquilla Creek Watershed cannot be said, but prior to this study substantive data upon which to base an adequate Statement of Environmental Impact were not available.

The following study is based on three months of systematic and intensive field investigations within the Aquilla Creek Watershed. Data collected during this period are presented in the following report and serve as the foundation upon which the recommendations at the

conclusion of the report are based. It must be realized that this period of time does not allow for study of the watershed throughout a full year's seasonal cycle nor does it allow for testing of archaeological sites for detailed evaluation. Therefore, the contents of this report should not be interpreted as definitive but should be treated as a base-line from which the effects of the Aquilla Lake Project can be measured.

ARCHAEOLOGICAL RESOURCES

OF THE

AQUILLA CREEK WATERSHED, TEXAS

by

S. Alan Skinner

and

Mark S. Henderson

ACKNOWLEDGEMENTS

The archaeological and historical inventory of the Aquilla Creek Watershed was conducted by the Archaeology Research Program at Southern Methodist University. The archaeological site survey and artifact analysis was carried out during May, June and July while the survey team was based at Fort Graham on Lake Whitney.

Danny Williams, Tom Beaty, Bill Fawcett, Paul McGuff Mike Van Hemert, Bill Westbury served as archaeological field assistants during the field survey. In the evenings and on rainy days this crew washed and analyzed the artifacts. Martha Carr, Larcie DeArman and Dorsey Bethune assisted with the artifact analysis.

Information on the archaeological resources within the watershed was provided by amateur archaeologists from Hillsboro, Waco, Corsicana, Dallas and Houston. We especially want to thank the Wimberlys in Hillsboro for allowing us to look at their collections from Aquilla Creek sites. Mr. Bill Young of Corsicana aided in the survey of the upper Aquilla Creek area. Mr's. Jay C. Blaine, C. A. Smith and R. K. Harris of Dallas provided information on site location and artifact assemblages. Mr. Frank Watt, H. C. Ballew and R. B. Green of Waco provided information on the archaeological resources of lower Aquilla Creek. Mr. C. K. Chandler of Houston advised us about additional archaeological resources within the county.

The survey could not have been completed without the aid and cooperation of many of the landowners involved; without their help in recognizing land boundaries and providing information about site location the survey would not have been accomplished.

The people of Hillsboro aided us in carrying out the study and without their help living and working would have been difficult. We want to thank the members of the Chamber of Commerce for their help and advice, especially we appreciate the help from Mr. James Prentice and Al Atteberry. Mr. Jack Dobbs the local representative

for the Brazos River Authority was most helpful. We received excellent local news coverage of the project through the help of Nelson Gallee of the Hillsboro Reporter and radio station KHBR. A stove and refrigerator for use at the Lake Whitney field camp were provided by Bond's Hardware and Mr. Paul Harvey of Texas Power and Light. Advise about the soils, location of land holdings and whereabouts of Indian sites was provided by the congenial staff of the Soil Conservation Service office in Hillsboro.

Gathering together historical records is a difficult job for someone unfamiliar with an area. We were assisted in this task by discussions with Mr. C. H. Stubblefield of Hillsboro, Mrs. Joe Atchison of Peoris, Mrs. Claude Parks of Whitney and various other local residents of the area.

The Corps of Engineers must be thanked for their help both in the office and in the field. The COE staff at Lake Whitney allowed us to use the reconstructed officer's quarters at Fort Graham as a field camp. Thanks to the help of C. W. Greason, Bobby Chapman and Louis Burnett our summer living arrangements were very comfortable. In the Fort Worth office Mr. L. E. Housman was always available to solve questions about the project. He was ably assisted by Mr. Durwood Jones and Mr. Sam Garrett who had the task of running down the answers to all sorts of requests.

The U. S. National Park Service, especially Mr. Douglas Scovill and Dr. Keith M. Anderson, of the Arizona Archeological Center, have been a constant source of information about the preparation of statements of environmental impact upon archaeological resources.

# INTRODUCTION

This report describes the findings of an archaeological site survey within the Aquilla Creek Watershed in Hill County, Texas. One hundred and twenty-five prehistoric sites were recorded during the survey which was concentrated in the area along Aquilla and Hackberry Creeks between State Highway 22 and Aquilla, Texas. Additional information about other archaeological sites within the watershed was provided by amateur archaeologists. Site testing was not included within the scope of the study.

The Aquilla Creek Watershed is located in central Texas within the southern portion of the Central Brazos River Basin. The watershed has a maximum length of 41 miles and a maximum width of 16 miles. Terrain within the watershed can be described as rolling and hilly with narrow valleys and streams which are moderately entrenched. The Eastern Cross Timbers, Blackland Prairie and Grand Prairie physiographic areas interdigitate and form an ecotone within the watershed, thereby making considerable environmental variation available within short distance.

The site survey reported herein was undertaken for the purpose of evaluating the cultural resources of this area with regard to the impact that construction of the proposed lake will have upon them. The report concludes with recommendations for salvage excavations which are needed in order to recover cultural information about the prehistoric occupation of the Aquilla Creek Watershed before construction is begun.

## PREVIOUS ARCHAEOLOGY

Archaeological investigations within the Aquilla Creek Watershed have been conducted by amateur archaeologists who have taken the time to record and report the many important sites in the area. An early description of the area was prepared by Frank Bryan and published in the Central Texas Archeologist (Bryan 1937). Bryan reports six prehistoric sites located south of Peoria. Each site is located in a sandy deposit and well above the floodplain of the creek. On the basis of the artifacts described, sinkers, projectile points and pottery, it would appear that the occupation represents about 5500 years (4000 B.C. to A.D. 1500).

In a definitive study on "Waco sinkers", Frank Watt (1938) describes sinkers from sites along Aquilla Creek, and it is believed that these artifacts can be attributed to the Early Archaic period (prior to 4000 B.C.).

Throughout the 40's and 50's, members of the Central Texas Archeological Society continued survey reconnaissance of Aquilla Creek and aided in salvage excavations at Lake Whitney. This research has yielded information about the presence of pottery-bearing sites located along the eastern edge of central Texas. The Chupek site is one of the better known "intrusive" sites within the area. The site is located on Aquilla Creek near its junction with the Brazos River. Frank Watt of Waco has studied the site and has reported that Alto Focus pottery is the only type of pottery found (Watt 1941, 1953).

On the basis of this research Krieger (1946) considers the site to be the location of a non-mound village related to the Caddoan Alto Focus of east Texas (Newell and Krieger 1949). Recent excavation by the University of Texas has attempted to determine the nature of the relationship(s) between the George C. Davis site in east Texas and the Chupek site (Dee Ann

Story, personal communication). Watt (1953) also reports the presence of Frankston focus pottery on several sites along Aquilla Creek, but this is considered to be separate from the Alto Focus materials.

Lake Whitney is located just west of the Aquilla Watershed and extensive salvage excavations were carried out there before the lake was built. This work, as reported by Stephenson and Jelks, focused upon the recording of stratigraphically useful sequences, excavation of the historic Stansbury site and preservation of shelter deposits which were threatened by the ease of accessibility provided by the lake. A sequence extending back to 500 B.C. and possibly older was outlined and many large prehistoric sites located on the sandy river terraces were recorded. No relationship between sites along the Brazos River at Lake Whitney and sites along Aquilla Creek were formulated although there is evidence that Waco sinkers are extremely rare at Lake Whitney and that Caddoan pottery of the Alto focus period is present in several rock shelters.

Prior to 1960 archaeological evidence for the presence of Early Man in the Aquilla area was based only upon the presence of an occasional late Paleo-Indian projectile found on the surface of a site. In 1962 the Ballew site was discovered in a peanut field near the juntion of Aquilla Creek and the Brazos River. This site was tested by F. Watt and Albert Redder with the advise of Dr. George A. Agogino, then of Baylor University. Recent excavations at Horn Rock Shelter by Watt and Redder have revealed evidence to suggest that Early Man was present in the Central Brazos River Valley as early as 10,800 years ago (Watt and Agogino 1968). The implication of this research is that we can expect to find evidence of Early Man throughout the study area if plowing has proceeded to a point where the recent overburden has been removed from the early archaeological deposits. Recent site survey at Lake Whitney (Skinner and Harris 1971) and information from amateur archaeologists's suggest that a similar time depth is present elsewhere on the Brazos River

and on tributaries such as Aquilla Creek.

Salvage excavations at Lake Waco (Story and Shafer 1965) have shown that the Brazos River has been aggrading (depositing a silt load) during the past 2500 years (Stricklin 1961). A similar pattern of rapid deposition has been reported at Lake Granbury (Skinner 1971) and at Lake Whitney. These factors suggest that archaeological sites which pre-date 500 B.C. can be expected to occur buried under several feet of sediment and therefore would not be readily visible on the ground surface.

In summary, archaeological research in the Aquilla area demonstrates that the Central Brazos River Valley has been continuously occupied since about 10,000 B.C. by Indians who lived a hunting and gathering way of life.

## NATURAL ENVIRONMENT

The Aquilla-Hackberry Creek Watershed is located primarily in the western portion of Hill County and extends into McClennan County on the south and Johnson County on the north. The watershed lies within two physiographic provinces, the Eastern Cross Timbers and the Blackland Prairie. The Woodbine formation underlies the Eastern Cross Timbers and the topography is moderately rolling and partially wooded with oaks and hickories. The Blackland Prairie is underlain by Cretaceous shales and limestones and grass is the dominant natural vegetation.

An east-west transect across Aquilla and Hackberry Creeks provides a convenient means of visualizing the variation of the environment within the area. For convenience, the transect has been divided into distinct zones or microenvironments (Coe and Flannery 1964) for the purpose of correlating the variation of the archaeological materials with specific situations. The microenvironmental zones are recognized on the basis of variations in topography, geology, vegetation, fauna and water resources. Six zones are recognized and described below; these include 1) floodplain, 2) the creek edge, 3) a rise or peninsula within the floodplain, 4) the edge of the floodplain and base of the upland, 5) the upland slope, and 6) the upland (Fig. 1).

1) Floodplain.

Aquilla and Hackberry Creeks are intermittent streams which drain into the Brazos River. Both creeks are entrenched into their respective floodplains. Much of the bottomland is in cultivation and pasture today. Flooding is a serious problem within the watershed and in areas where the original ground cover has been cleared erosion has become a problem.

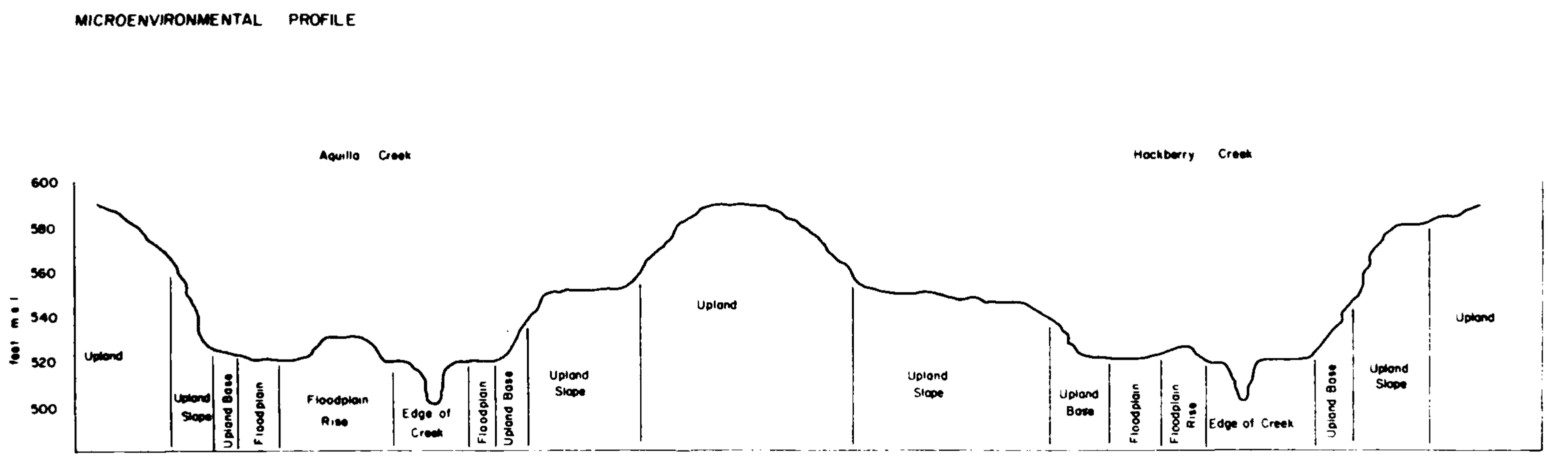


Figure 1. Microenvironmental Profile.

2) Creek edge.

Overbank flooding has deposited low levees along the creek banks due to the deposition of heavier silts adjacent to the creek. Upper and understory foliage is thick along the creek banks. The creek contains mussels, frogs, turtles, fish and snakes and attracts racoons and turtles.

3) Rise or peninsula within the floodplain.

Stabilized remnants of Pleistocene terraces occur throughout the watershed and appear as sandy knolls within the floodplain. They rise in elevation from 510-530' m.s.l. and are isolated as islands when the bottomland is flooded. The sandy soil is covered with trees and grass if not in cultivation.

4) Floodplain edge/Upland base.

This zone is located throughout the reservoir between the 510-535' contour. Soils from the floodplain and the upland interdigitate at this juncture. Distance to the creek varies but water is available in the vicinity.

5) Upland slope.

Natural terracing is the most prominent feature of the upland slope. The slope is moderately rolling with few steep bluffs and many broad level areas which support a tree cover of oaks and elms. The ground has a heavy grass mat and erosion is prominent only where clearing has allowed removal of the grass. Oaks are prominent on the slopes of the watershed especially in the Eastern Cross Timbers area.

6) Upland.

The upland zone is that area above 560' m.s.l. that is gently rolling and supports a dense cover of oaks and hickories or grass. Water is unavailable in

the area except after rains, but the vegetation is thick. Squirrels and rabbits are frequently observed in this area and deer are also found here.

## METHODOLOGY

The archaeological survey of the Aquilla Creek area was conducted in order to maximize location of relevant cultural materials in all areas to be affected by future construction and development activities. The survey was conducted on foot by parties of two or three men. Location, apparent size, elevation above sea level, and other pertinent information about each site was recorded on survey forms and U.S.G.S. maps. Surface collections were made at most sites; however, at several sites selective samples were gathered because it was felt that controlled surface collection would be profitable when future work is carried out. Surface materials were washed, catalogued and analyzed at the field laboratory located at Lake Whitney. These materials, along with site distribution data, form the basis for the recommendations outlined in this report.

The investigators feel that the major portion of the survey area had adequate exposure to provide a reliable indication of the archaeological sites present. However, due to the activity of many artifact collectors it was impossible to recover an artifact sample representative of all activities and periods at several sites. In addition, not all the area was surveyed for archaeological sites since several land owners were not willing to allow the survey party to have access to their property. The result of this reticence was that several sites known to amateur archaeologists in Waco and Hillsboro were not visited and evaluated. Nevertheless, the survey covered areas representative of the environmental variation within the watershed and the available data has been used to plan future work (Fig. 2).


Figure 2. Location of Archaeological Sites within Aquilla Creek Watershed.

TABLE 1. Aquilla Watershed Settlement Data.

| | |
|---|---|
| Site - | Sites are numbered consecutively within Hill County starting with 41 HI 31. |
| Elevation - | Refers to feet above mean sea level as taken from U.S.G.S. 7.5 minute series topographic maps: Peoria, Texas; Aquilla, Texas. |
| Locus - | Refers to the six microenvironmental zones described in the report: 1) Floodplain, 2) Creek edge, 3) Floodplain rise or peninsula, 4) Upland base, 5) Upland slope, and 6) Upland. |
| Description - | Refers to the evidence of each archaeological site as exposed by erosion, area is presented in meters, wherever possible a temporal designation is given based on the presence of typologically or technologically diagnostic artifacts. It must be remembered that other time periods may be found present at some sites but that erosion or excessive surface collecting have obscured them at present. |
| Number of artifacts - | Provides a measure of site density and/or exposure. Starred numbers indicate those sites at which 29 or more artifacts were collected and are used for intersite comparison. |
| Activity - | Defined on the basis of materials collected during survey. Categories and indicator artifacts are: 1) Tool manufacture - flakes/chips, cores, bifaces, hammerstones; 2) Mussel gathering - mussel shell in such an abundance to indicate that |

shell tools or ornaments are not represented;

3) Plant processing - manos, metates, hammerstones;
4) Hunting - projectile points;
5) Quarrying - presence of unmodified stone, cortex flakes/chips, hammerstones.

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 31 | 530 | Upland slope | Scattered surface exposure of lithic material in cultivated field. | 4 | 1 |
| 41 HI 32 | 540 | Upland slope | Surface scatter of lithic debris, 200 m. diameter. | 20 | 1,5 |
| 41 HI 33 | 550 | Upland slope | Scattered surface exposure of lithic material, 50 m. diameter. | 25 | 1 |
| 41 HI 34 | 490 | Flood-plain | Buried midden deposit, 50 cm. thick, area undetermined, Late Archaic. | 18 | 1,4 |
| 41 HI 35 | 515 | Flood-plain | Lithic concentration along sandy ridge, 100 x 30 m. | 138* | 1,3,5 |
| 41 HI 36 | 560 | Upland | Exposure of lithic debris, 30 m. diameter. | 62* | 1,3 |
| 41 HI 37 | 520 | Upland Base | Surface exposure of lithic debris and mussel shell, 50 m. diameter, Late Archaic. | 2 | 1,2 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 38 | 520 | Upland Base | Concentration of shell and lithic debris, 15 x 10 m. | 27 | 1,2 |
| 41 HI 39 | 500 | Flood-plain | Lithic debris and mussel shell exposed, in gullies, area 100 x 40 m. | 63* | 1,2,3,4 |
| 41 HI 40 | 500 | Creek Edge | Mussel shell midden exposed by cultivating area 10 x 8 m. | 20 | 1,2,3 |
| 41 HI 41 | 510 | Creek Edge | Concentration of lithic debris 100 m. in diameter, Late Archaic. | 42* | 1,3,4 |
| 41 HI 42 | 510 | Creek Edge | Scattered concentration of lithic debris and mussel shell, 200 x 100 m. | 296* | 1,2,3 |
| 41 HI 43 | 490 | Creek Edge | Shell midden with scattered lithic debris, area 45 m. diameter, Late Archaic. | 23 | 1,2,3,4 |
| 41 HI 44 | 490 | Creek Edge | Shell midden with scattered lithic debris, 40 x 30 m. in area, Late Archaic. | 17 | 1,2,3,4 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 45 | 500 | Flood-plain | Concentration of lithic debris, 75 x 30 m. | 17 | 1,3 |
| 41 HI 46 | 500 | Creek Edge | Shell midden with lithic debris, area 30 m. diameter. | 13 | 1,2,3 |
| 41 HI 47 | 500 | Creek Edge | Shell midden. | 6 | 1,2,3 |
| 41 HI 48 | 500 | Creek Edge | Camp midden with bone, shell, lithic debris, pottery, 30 x 40 m., Neo-American and Late Archaic. | 34* | 1,2,3,4 |
| 41 HI 49 | 490 | Creek Edge | Midden with lithic debris, 30 x 60 m. | 10 | 1,2,3 |
| 41 HI 50 | 490 | Creek Edge | Shell midden with bone and lithic debris, 50 m. in diameter. | 11 | 1,2,3 |
| 41 HI 51 | 500 | Flood-plain Rise | Camp midden with shell, bone, lithic debris and tools, 46 x 30 m. | 57* | 1,2,3,4 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 52 | 490 | Flood-plain | Scattered concentration of shell and lithic debris, 10 x 5 m. | -- | 1,2,3 |
| 41 HI 53 | 505 | Flood-plain | Exposed concentration of lithic debris and shell, 100 x 50 m. Late Archaic. | 140* | 1,2,3,4 |
| 41 HI 54 | 490 | Creek Edge | Buried shell midden with bone, lithic debris and burned sandstone, 20 m. in diameter. | -- | 1,2,3 |
| 41 HI 55 | 540 | Upland slope | Lithic scatter on hill slope, 300 x 50 m., Late Archaic. | 78* | 1,4 |
| 41 HI 56 | 510 | Base | Concentration of lithic debris and mussel shell, 25 m. in diameter, Late Archaic. | 77* | 1,2,3,4 |
| 41 HI 57 | 560 | Upland | Lithic workshop with some camp midden, area 100 m. in diameter, Neo-American. | 78* | 1,4 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 58 | 520 | Upland Base | Scattered lithic debris in cultivated field. | 3 | 1 |
| 41 HI 59 | 570 | Upland | Scattered lithic debris exposed by road cut. | 10 | 1 |
| 41 HI 60 | 510 | Flood-plain Rise | Camp midden with lithic debris, tools, mussel shell, 50 x 20 m., Late Archaic. | 100* | 1,2,3,4 |
| 41 HI 61 | 500 | Flood-plain Rise | Scattered lithic debris over area 50 x 25 m. | 17 | 1 |
| 41 HI 62 | 535 | Flood-plain Rise | Concentration of lithic debris in area 15 x 20 m. | 76* | 1 |
| 41 HI 63 | 570 | Upland | Surface exposure of lithic remains in area 25 m. in diameter. | 71* | 1,3 |
| 41 HI 64 | 510 | Creek Edge | Widely scattered area of lithic debris. | 14 | 1 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 65 | 520 | Upland Base | Small concentration of lithic debris, 15 m. diameter. | 24 | 1 |
| 41 HI 66 | 530 | Upland Rise | Camp midden with lithic debris, mussel shell, 125 x 50 m. in area, Late Archaic. | 182* | 1,2,3,4 |
| 41 HI 67 | 520 | Rise | Scattered lithic debris over area 15 x 8 m., Neo-American. | 25 | 1,4 |
| 41 HI 68 | 515 | Flood-plain Rise | Scattered lithic debris in area 150 x 20 m. | 15 | 1,3 |
| 41 HI 69 | 520 | Flood-plain Rise | Concentration of lithic debris, area 75 x 50 m. | 31* | 1 |
| 41 HI 70 | 520 | Upland base | Light scatter of lithic debris, 150 x 50 m. | 13 | 1 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 71 | 510 | Creek edge | Camp midden with mussel shell, lithic debris and grinding tools, 70 x 10 m. | 19 | 1,3 |
| 41 HI 72 | 515 | Creek edge | Camp midden with bone, lithic debris and tools, 300 x 200 m., Late Archaic. | 525* | 1,3,4 |
| 41 HI 73 | 510 | Creek edge | Midden in plowed field with shell, bone, lithic debris and tools, 50 x 30 m., Late Archaic. | 62* | 1,2,3,4 |
| 41 HI 74 | 540 | Upland base | Scatter of lithic debris, 20 x 15 m. | 17 | 1,3 |
| 41 HI 75 | 520 | Upland base | Lithic debris concentration with bone and fire-cracked rock. | -- | 1 |
| 41 HI 76 | 520 | Upland base | Exposed area of lithic debris, 30 m. in diameter. | 7 | 1 |
| 41 HI 77 | 500 | Rise | Concentration of lithic debris on sandy rise, 10 x 20 m. | 12 | 1 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 78 | 530 | Upland base | Thin scatter of lithic debris. | 4 | 1 |
| 41 HI 79 | 540 | Upland slope | Concentration of lithic debris amid cobble field, 100 x 75 m. | 136* | 1 |
| 41 HI 80 | 500 | Creek edge | Lithic concentration, 15 x 20 m. | 31* | 1 |
| 41 HI 81 | 530 | Upland base | Dense concentration of lithic debris and tools, pottery, 50 x 20 m., Late Archaic, Neo-American. | 319* | 1,3,4 |
| 41 HI 82 | 520 | Upland base | Scattered lithic debris in area 15 x 10 m. | 32* | 1 |
| 41 HI 83 | 520 | Upland base | Small (30 x 10 m.) area of lithic debris, Late Archaic | 288* | 1,4 |
| 41 HI 84 | 520 | Upland base | Scattered area with lithic debris, 20 x 50 m., Neo-American | 115* | 1,4 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 85 | 530 | Upland base | Dense area of lithic debris, projectiles, ground stone, 75 m. in diameter, Paleo-Indian, Late Archaic. | 2 | 1,4 |
| 41 HI 86 | 540 | Upland slope | Thin scatter of lithic debris. | 27 | 1 |
| 41 HI 87 | 530 | Upland slope | Scatter of lithic debris, 20 x 10 m. | 14 | 1 |
| 41 HI 88 | 525 | Upland slope | Diffused concentration of lithic debris, 75 x 25 m. | 48* | 1 |
| 41 HI 89 | 510 | Flood-plain rise | Concentration of camp midden, including bone, shell and lithic debris. | 73* | 1,2 |
| 41 HI 90 | 520 | Upland slope | Surface scatter of lithic debris. | 7 | 1 |
| 41 HI 91 | 520 | Upland slope | Surface scatter of lithic debris in area 20 m. in diameter. | 5 | 1 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 92 | 520 | Upland slope | Concentration of lithic debris, 20 m. in diameter. | 50* | 1 |
| 41 HI 93 | 540 | Upland slope | Scatter of lithic materials, Late Archaic. | 10 | 1,4 |
| 41 HI 94 | 510 | Creek edge | Scatter of lithic materials in area 35 x 25 m., Late Archaic. | 23 | 1,4 |
| 41 HI 95 | 510 | Creek edge | Camp site with lithic debris, projectile points, ground stone, area 50 x 60 m., Late Archaic. | 31* | 1,3,4 |
| 41 HI 96 | 540 | Upland slope | Concentration of lithic debris, 50 m. in diameter. | 11 | 1,3 |
| 41 HI 97 | 550 | Upland slope | Camp refuse on site surface including lithic debris, projectiles and ground stone, 200 x 125 m., Late Archaic. | 202* | 1,2,3,4 |
| 41 HI 98 | 540 | Upland slope | Lithic debris, projectiles, and hammerstones in area 150 x 50 m., Late Archaic. | 6 | 1,4 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 99 | 560 | Upland | Thin concentration of lithic materials, 10 m. in diameter, Late Archaic. | 6 | 1,4 |
| 41 HI 100 | 530 | Upland base | Concentration of lithic materials, 50 x 75 m. | 64* | 1,4 |
| 41 HI 101 | 540 | Upland slope | Scattered litter of lithic debris, 70 x 20 m. | 16 | 1 |
| 41 HI 102 | 590 | Upland | Dense concentration of lithic materials, 30 x 20 m. area, Late Archaic. | 268* | 1,3,4 |
| 41 HI 103 | 550 | Upland slope | Chipping workship. | 5 | 1 |
| 41 HI 104 | 560 | Upland slope | Scattered lithic debris, area 150 m. long. | 12 | 1 |
| 41 HI 105 | 530 | Flood-plain rise | Camp midden includes lithic debris, ground stone, 25 x 15 m. | 13 | 1,3 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 106 | 530 | Upland base | Diffused area of lithic debris, 25 m. in diameter. | 36* | 1 |
| 41 HI 107 | 570 | Upland | Thin scatter of lithic debris, 20 x 10 m. | 22 | 1 |
| 41 HI 108 | 530 | Upland Base | Scatter of lithic debris, 5 m. in diameter | 8 | 1 |
| 41 HI 109 | 570 | Upland Base | Concentration of lithic artifacts, 25 x 20 m., Late Archaic. | 39* | 1,4 |
| 41 HI 110 | 550 | Upland Slope | Thin scatter of lithic debris. | 13 | 1 |
| 41 HI 111 | 555 | Upland Slope | Dense concentration of camp refuse, 100 x 15 m., Middle Archaic. | 117* | 1,3,4 |
| 41 HI 112 | 550 | Upland Slope | Surface scatter of lithic materials, 75 x 25 m., Late Archaic. | 71* | 1,4 |
| 41 HI 113 | 540 | Upland Slope | Thin scatter of lithic debris, 60 x 30 m. | 29* | 1 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 114 | 540 | Upland Slope | Scatter of lithic debris, 25 m. in diameter. | 14 | 1 |
| 41 HI 115 | 550 | Upland Slope | Concentration of camp site refuse, mano, lithic debris, projectile, 70 x 30 m., Late Archaic. | 82* | 1,3,4 |
| 41 HI 116 | 540 | Upland Slope | Thin scatter of lithic debris, 50 x 20 m. | 16 | 1 |
| 41 HI 117 | 550 | Upland Slope | Scatter of lithic debris, projectile, mano, area 125 x 100 m., Late Archaic. | 42* | 1,3,4 |
| 41 HI 118 | 570 | Upland | Camp site midden includes mano, projectiles, lithic debris, 30 x 25 m., Late Archaic. | 40* | 1,3,4 |
| 41 HI 119 | 550 | Upland Base | Lithic concentration diffused over area 400 x 100 m., Late Archaic. | 16 | 1,2,4 |
| 41 HI 120 | 550 | Upland Base | Scattered lithic debris, 200 x 75 m., Neo-American. | 26 | 1,4 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 121 | 540 | Upland Slope | Thin scatter of lithic materials, 10 m. in diameter. | 82* | 1 |
| 41 HI 122 | 530 | Upland Base | Thin scatter of lithic debris, 20 m. in diameter. | 5 | 1 |
| 41 HI 123 | 540 | Upland Slope | Concentration of camp midden including shell, mano and lithic debris, 75 x 30 m. | 48* | 1,2,3 |
| 41 HI 124 | 540 | Upland Slope | Scatter of lithic debris, 150 x 60 m. | 18 | 1 |
| 41 HI 125 | 540 | Upland Slope | Camp midden with shell and lithic debris, 150 x 50 m. | 94* | 1,2 |
| 41 HI 126 | 530 | Upland Base | Scatter of midden debris including mussel shell, 75 x 100 m. | 22 | 1,2 |
| 41 HI 127 | 525 | Flood-plain | Shell midden with lithic artifacts, 75 x 50 m. | 17 | 1,2 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 128 | 525 | Flood-plain | Thin scatter of shell and lithic debris, 50 m. in diameter. | 1 | 1,2 |
| 41 HI 129 | 525 | Flood-plain | Concentration of lithic debris, shell, mano, projectiles, 100 x 40 m., Late Archaic. | 107* | 1,2,3,4 |
| 41 HI 130 | 535 | Upland Base | Scatter of shell and lithic debris, 30 m. in diameter. | 11 | 1,2 |
| 41 HI 131 | 530 | Flood-plain | Scatter of lithic debris and mussel shell, 30 x 60 m. | 10 | 1,2 |
| 41 HI 132 | 540 | Flood-plain | Thin scatter of lithic debris, 20 x 5 m. | 6 | 1 |
| 41 HI 133 | 550 | Upland Slope | Scatter of lithic debris, 50 m. in diameter. | 7 | 1 |
| 41 HI 134 | 550 | Upland Slope | Scattered concentration of camp refuse including manos and metate, 75 x 30 m. | 20 | 1,2,3 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 135 | 530 | Upland Slope | Concentration of shell and lithic artifacts, 100 x 40 m. | 31* | 1,2,4 |
| 41 HI 136 | 560 | Upland | Scatter of lithic debris. | 2 | 1 |
| 41 HI 137 | 550 | Upland | Dense concentration of lithic debris and mussel shell, 125 x 100 m. | 67* | 1,2,4 |
| 41 HI 138 | 550 | Upland | Thin scatter of lithic artifacts and shell, 10 m. in diameter, Late Archaic. | 9 | 1,2,4 |
| 41 HI 139 | 550 | Upland | Concentration of camp debris including shell, lithic debris, projectiles and hammerstones, 100 x 75 m., Late Archaic. | 130* | 1,2,4 |
| 41 HI 140 | 550 | Upland Slope | Lithic workshop, 100 x 30 m., Late Archaic. | 30* | 1,2,4 |
| 41 HI 141 | 550 | Upland | Camp debris scattered over area 175 x 35 m., Late Archaic. | 76* | 1,2,3,4 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 142 | 540 | Flood-plain Rise | Concentration of camp site refuse including shell mano and projectiles, Middle and Late Archaic. | 119* | 1,2,3,4 |
| 41 HI 143 | 560 | Upland Slope | Dense concentration of shell and lithic debris, 25 m. diameter, Late Archaic. | 54* | 1,2,4 |
| 41 HI 144 | 545 | Upland Slope | Thin scatter of lithic debris and mussel shell. | 17 | 1,2 |
| 41 HI 145 | 510 | Creek Edge | Concentration of cultural refuse, 100 x 50 m. | 64* | 1,5 |
| 41 HI 146 | 550 | Upland | Scatter of lithic debris, cores, bifaces and hammerstones, 50 x 30 m. | 36* | 1 |
| 41 HI 147 | 520 | Creek Edge | Dense scatter of camp refuse, 100 x 50 m., Paleo-Indian, Late Archaic. | 125* | 1,3,4 |
| 41 HI 148 | 530 | Upland Base | Thin scatter of lithic debris, 75 x 30 m. | 10 | 1 |

| SITE | ELEV. | LOCUS | DESCRIPTION | NO. ARTI. | ACTIVITY |
|---|---|---|---|---|---|
| 41 HI 149 | 520 | Upland Base | Scattered camp refuse, 15 x 5 m. | 8 | 1,2 |
| 41 HI 150 | 555 | Upland | Camp refuse including shell, projectiles and lithic debris in area 120 x 35 m., Late Archaic. | 210* | 1,2,4 |
| 41 HI 151 | 555 | Upland | Thin scatter of lithic debris, 30 m. in diameter. | 49* | 1 |
| 41 HI 152 | 530 | Upland Base | Scattered lithic debris and tools, Late Archaic. | 53* | 1,4 |
| 41 HI 153 | 530 | Upland Base | Concentration of lithic artifacts, area 25 x 20 m. | 86* | 1 |
| 41 HI 154 | 520 | Upland Base | Dense concentration of camp refuse, 200 x 75 m., Middle Archaic. | 377* | 1,2 |
| 41 HI 155 | 530 | Upland Base | Thin lithic scatter, 30 m. in diameter. | 15 | 1 |

## SITE DISTRIBUTION

The distribution of archaeological sites is related to the microenvironmental variation within the watershed as described in the NATURAL ENVIRONMENT section of this report. It is expected that distinct artifact assemblages will be correlated with specific situations if different activities were carried out on spatially separated areas within the study area. Moreover, if there were changes in the subsistence pattern of the prehistoric inhabitants throughout the periods represented, then we can expect to find different site distribution patterns which reflect these differences (Fig. 3,4).

1) Floodplain Sites -- 11 sites (8.9%). Sites in this situation are frequently inundated by overbank flooding of Aquilla and Hackberry Creeks. Recent deposition may have covered sites in this location; however, due to the active cultivation of much of the floodplain and the resulting exposure, we expect that this area was not heavily occupied. The two dateable sites (HI53 and 129) have evidence of Late Archaic occupation. Site size based on sites with adequate size artifact collections averages 4000 square meters.

2) Floodplain Rise Sites -- 12 sites (9.6%). This zone contains both large sites showing evidence of intensive occupation and small limited occupation sites. Sites in this situation would be isolated during bottomland flooding. Seven of the sites located on rises have collections of sufficient size to be studied thus suggesting that occupation is more intense on the rises and peninsulas than on the floodplain. Evidence of occupation during Middle Archaic, Late Archaic and Neo-American periods was found.

3) Creek Edge Sites -- 20 sites (16.0%). All of these sites are located along Aquilla Creek. This may be due to the deeper entrenchment and development of a

Fig. 3a. Surveying for archaeological sites in a cultivated field located in the Aquilla Creek floodplain. Creek is marked by trees in background.

Fig. 3b. Recording and collecting surface artifacts at site 41HI150 located in the upland south of Cobb Creek.

Fig. 4a. Recording an upland slope site on the east site of Hackberry Creek.

Fig. 4b. View of post oak vegetation on the upland slope near Dam Site B. Site 41HI137 is located in the grassy area near the center of the photograph.

TABLE 2. Sites within Aquilla Creek Watershed grouped by microenvironment. Asterisk indicates sites having artifact sample of 29 or more specimens.

| FLOOD-PLAIN | CREEK EDGE | FLOOD-PLAIN RISE | UPLAND BASE | UPLAND SLOPE | UPLAND |
|---|---|---|---|---|---|
| HI 34 | HI 40 | HI 51* | HI 37 | HI 31 | HI 36* |
| HI 35* | HI 41* | HI 60* | HI 38 | HI 32 | HI 57* |
| HI 39* | HI 42* | HI 61 | HI 56* | HI 33 | HI 59 |
| HI 45 | HI 43 | HI 62* | HI 68 | HI 55* | HI 63* |
| HI 52 | HI 44 | HI 66* | HI 65 | HI 79* | HI 99 |
| HI 53* | HI 46 | HI 67 | HI 70 | HI 86 | HI 102* |
| HI 127 | HI 47 | HI 68 | HI 74 | HI 87 | HI 107 |
| HI 128 | HI 48* | HI 69* | HI 75 | HI 88* | HI 109* |
| HI 129* | HI 49 | HI 77 | HI 76 | HI 90 | HI 118* |
| HI 131 | HI 50 | HI 89* | HI 78 | HI 91 | HI 136 |
| HI 132 | HI 54 | HI 105 | HI 81* | HI 92* | HI 137 |
| 11 sites | HI 64 | HI 142* | HI 82* | HI 93 | HI 138 |
| | HI 71 | 12 sites | HI 83* | HI 96 | HI 139* |
| | HI 72* | | HI 84* | HI 97* | HI 141* |
| | HI 73* | | HI 85 | HI 98* | HI 146* |
| | HI 80* | | HI 100* | HI 101 | HI 150* |
| | HI 94 | | HI 106* | HI 103 | HI 151* |
| | HI 95* | | HI 108 | HI 104 | 17 sites |
| | HI 145* | | HI 119 | HI 110 | |
| | HI 147* | | HI 120 | HI 111* | |
| | 20 sites | | HI 122 | HI 112* | |
| | | | HI 126 | HI 113* | |
| | | | HI 130 | HI 114 | |
| | | | HI 148 | HI 115* | |
| | | | HI 149 | HI 116 | |
| | | | HI 152* | HI 117* | |
| | | | HI 153* | HI 121* | |
| | | | HI 154* | HI 123* | |
| | | | HI 155 | HI 124 | |
| | | | 29 sites | HI 125* | |
| | | | | HI 133 | |
| | | | | HI 134 | |
| | | | | HI 135* | |
| | | | | HI 140* | |
| | | | | HI 143* | |
| | | | | HI 144 | 36 sites |

natural levee along Aquilla Creek. The majority of these sites are small in area and several are mussel shell middens. Paleo-Indian occupation is evidenced at one site (HI147). Late Archaic occupation is represented at ten sites and Neo-American occupation occurs at two sites. One of the latter contains trade pottery from east Texas.

4) Floodplain Edge/Upland Base Sites -- 29 sites (23.2%). Although this area has the next largest number of sites only ten sites have adequate collections for study. This factor reflects the fact that there is variation in site size and in exposure. Nevertheless, this zone appears to have been occupied from Paleo-Indian to Neo-American times and the heaviest concentration of Neo-American sites occurs here. One of the Neo-American sites includes Caddoan ceramics from east Texas.

5) Upland Slope Sites -- 36 sites (28.9%). Sites in this zone appear to be situated in order to exploit the resources of the upland as well as the bottomland. Although there is evidence for occupation from Paleo-Indian to Neo-American times, the heaviest occupation appears to have been during the Late Archaic. Caddoan pottery was found at site 41HI 144.

6) Upland Sites -- 17 sites (13.6%). The Late Archaic is the major occupation of this zone that is reflected by the artifact assemblages collected (10 sites). Assemblage size shows that many sites in this zone have been exposed by erosion since 11 of the 17 sites have collections that were studied. Site size ranges from 15,000 to 500 square meters and averages 4893 square meters.

The site distribution shows that site size is generally a constant regardless of associated micro-environmental zone. Artifact collections of 29 or more specimens range from 34% of the Upland Base sites to 64% of the upland sites; thereby suggesting that erosion and exposure can be treated as a constant

TABLE 3. Aquilla Creek Watershed sites separated into time periods on the basis of diagnostic artifacts and listed by microenvironment. Sites without diagnostic artifacts are not included.

| | FLOOD-PLAIN | CREEK EDGE | FLOOD-PLAIN RISE | UPLAND BASE | UPLAND SLOPE | UPLAND |
|---|---|---|---|---|---|---|
| PALEO-INDIAN | | HI 147 | | HI 85 | | |
| MIDDLE ARCHAIC | | | HI 142 | HI 154 | HI 111 | |
| LATE ARCHAIC | HI 53 | HI 40 | HI 51 | HI 81 | HI 55 | HI 102 |
| | HI 129 | HI 43 | HI 60 | HI 83 | HI 93 | HI 109 |
| | | HI 44 | HI 66 | HI 119 | HI 97 | HI 118 |
| | | HI 48 | HI 142 | HI 152 | HI 98 | HI 137 |
| | | HI 50 | | | HI 99 | HI 138 |
| | | HI 72 | | | HI 112 | HI 139 |
| | | HI 73 | | | HI 115 | HI 141 |
| | | HI 94 | | | HI 117 | HI 150 |
| | | HI 95 | | | HI 125 | |
| | | HI 147 | | | HI 135 | |
| | | | | | HI 140 | |
| | | | | | HI 143 | |
| NEO-AMERICAN | | HI 48 | HI 51 | HI 81 | HI 121 | HI 57 |
| | | HI 50 | HI 67 | HI 84 | HI 144 | |
| | | | | HI 85 | | |
| | | | | HI 120 | | |

throughout the watershed. Late Archaic sites occur in all but the Floodplain. Paleo-Indian occupation is represented in three zones and we expect that additional work will show that Paleo-Indian utilization occurred in all zones.

## ARTIFACT ANALYSIS

Analysis of the artifacts collected at each site located during the survey is based on the assumption that these cultural materials represent information on the technology, subsistence activities, composition and size of social groups, periods of occupation, and the cultural affiliations of the prehistoric inhabitants of the sites. Materials collected include ceramics, lithic debris and tools, fire-cracked rock, and faunal remains.

The analysis is centered on quantifying lithic materials as a means of determining possible activity differences in different environmental situations. The lithic material most commonly utilized by the prehistoric inhabitants is a fine-grained chert (or "flint") available as nodules in the Edwards limestone or in pre-Pleistocene gravels. Sandstone was the predominant material from which ground stone tools were made.

The collected materials were analyzed into the following categories:

a) Lithic Debris - This category is composed of all flakes and chips which have not been further modified by secondary retouch. These may result either as the by-products of tool manufacture, or the purposeful production of flakes for use as tools. It is predicted that the size of lithic debris, amount of cortex remaining on the dorsal surface, and type of flake platform will reflect the stone working technology and the steps involved in core reduction and/or tool manufacture.

In this analysis, Chips are flake fragments which have no platform present and are described only as primary, secondary, or interior fragments. This category is not dependent upon size, and includes some potentially modifiable pieces. Primary flakes (and chips) are those having 75% or more of the dorsal surface covered with cortex. Secondary flakes (and chips) have 1-74% of the dorsal surface covered with cortex.

Interior flakes (and chips) have no cortex on the dorsal surface. Relative amounts of these categories is seen as a reflection of the stage of tool manufacturing involved in their production. Biface thinning flakes (BFT) are those having an acute platform to flake angle, a faceted platform, and a generally vaulting form (Shiner 1969; Shafer 1969).

b) Cores and Bifaces were separated on the basis of gross appearance, but have been combined into a single unit for comparative purposes as representing initial stages in the process of tool manufacture. It is assumed that none of these represents a finished tool, but wear pattern studies would have to be made in order to confirm this.

c) Chipped Stone Tools include "dart" and "arrow" points and preforms, large chopping tools, and all secondarily modified chips and flakes. Retouched chips and flakes are the predominant tool type encountered at all sites. Only pieces showing definite evidence of regular intentional retouching were included in this category, as opposed to a small number of flakes and chips exhibiting irregular edge breakage due possibly to use of an unmodified piece. Dart and arrow points were separated on the basis of gross size and appearance.

d) Pecked and Ground Stone Tools occur in limited quantities at a number of sites. This category includes stones utilized as hammerstone and grinding stones. Frequently combinations of these types occur on a single specimen. Materials utilized are normally quartzite cobbles for hammerstones, and sandstone slabs for grinding and nutting stones. The occurrence of ground stone tools is taken as an indication of the processing of wild plant foods or domesticated foods.

e) Faunal Remains - Fragments of animal bone and fresh-water mussel shell were noted at many sites. Excavation, as well as pH tests of the soils at various sites will be required to determine if faunal remains have been adequately preserved to give an indication

of the animal food resources utilized by the prehistoric inhabitants.

In order to determine if different activities were being performed in different areas, all materials were quantified according to the zone in which they occurred. These data are tabulated in Tables 4 through 10 and selected examples illustrated in Figure 5.

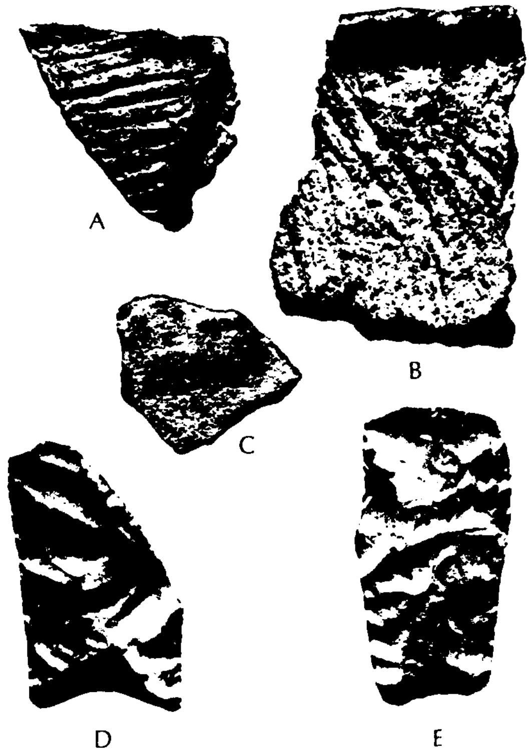


Figure 5. Artifacts from Prehistoric Sites within Aquilla Creek Watershed.
a, Bullard Brushed pottery-41HI48; b, Bullard Brushed pottery rim sherd-41HI144; c, Bone tempered plainware sherd-41HI81; d, Plainview projectile point base-41HI147; Angostura projectile point base-41HI85. Artifacts shown are actual size.

TABLE 4a. ARTIFACT ASSEMBLAGE - Floodplain Sites.

| SITE | LITHIC DEBRIS | CORES/ BIFACES | LITHIC TOOLS | GROUND/ PECKED STONE | BONE | SHELL | N |
|---|---|---|---|---|---|---|---|
| 41 HI 35 | 68.0% | 15.2% | 3.6% | 13.0% | - | - | 138 |
| 41 HI 39 | 54.9 | 18.0 | 8.0 | - | X | - | 63 |
| 41 HI 53 | 73.2 | 7.8 | 3.5 | 15.9 | X | X | 140 |
| 41 HI 129 | 61.6 | 14.9 | 9.2 | 13.0 | X | - | 107 |
| AVERAGE | 64.4% | 13.9% | 6.0% | 13.9% | | | |

TABLE 4b. LITHIC DEBRIS - Floodplain Sites.

| SITE | PRI. | SEC. | INT. | BFT | N | % FLAKES |
|---|---|---|---|---|---|---|
| 41 HI 35 | 10.5 | 38.9 | 47.3 | 3.1 | 95 | 75.7 |
| 41 HI 39 | 2.1 | 56.5 | 41.3 | - | 46 | 73.8 |
| 41 HI 53 | 3.8 | 61.1 | 31.6 | .9 | 103 | 53.3 |
| 41 HI 129 | 15.1 | 31.8 | 50.0 | 3.1 | 66 | 63.3 |
| AVERAGE | 7.4 | 47.1 | 42.3 | 2.3 | | 66.5 |

TABLE 5a. ARTIFACT ASSEMBLAGE - Creek Edge Sites.

| SITE NO. | FLAKES/ CHIPS | BIFACES/ CORES | LITHIC TOOLS | PECKED/ GROUND STONE | SHELL | BONE | N |
|---|---|---|---|---|---|---|---|
| Hi 41 | 40.4 | 16.6 | 11.7 | 30.9 | - | - | 42 |
| Hi 42 | 71.5 | 11.3 | 16.6 | 7.9 | - | - | 296 |
| Hi 48 | 49.9 | 20.5 | 20.4 | 5.8 | X | X | 34 |
| Hi 72 | 74.8 | 8.4 | 11.1 | 4.8 | - | X | 524 |
| Hi 73 | 78.9 | 9.6 | 4.8 | 6.4 | X | X | 62 |
| Hi 80 | 67.6 | 32.2 | - | - | - | - | 31 |
| Hi 95 | 61.2 | 9.6 | 16.0 | 12.8 | - | X | 31 |
| Hi 145 | 45.6 | 23.9 | 17.1 | 9.3 | - | - | 64 |
| Hi 147 | 78.8 | 12.0 | 9.6 | 3.2 | - | - | 125 |
| AVERAGE | 63.2 | 16.0 | 11.9 | 9.0 | | | |

TABLE 5b. LITHIC DEBRIS - Creek Edge Sites.

| SITE NO. | PRI. | SEC. | INT. | BFT | N | % FLAKES |
|---|---|---|---|---|---|---|
| Hi 41 | 29.4 | 29.4 | 29.4 | 11.8 | 17 | 100 % |
| Hi 42 | 15.1 | 41.9 | 41.9 | 1.2 | 172 | 39.2 |
| Hi 48 | 5.9 | 70.6 | 23.5 | - | 17 | 41.2 |
| Hi 72 | 10.7 | 55.0 | 32.8 | 1.5 | 393 | 54.0 |
| Hi 73 | 6.8 | 52.5 | 40.7 | - | 59 | 46.8 |
| Hi 80 | 38.1 | 61.9 | - | - | 21 | 32.3 |
| Hi 95 | - | 47.4 | 47.4 | 5.3 | 19 | 48.4 |
| Hi 145 | 23.3 | 50.0 | 26.7 | - | 30 | 35.9 |
| Hi 147 | 13.8 | 44.7 | 39.4 | 2.1 | 94 | 40.8 |
| AVERAGE | 15.9 | 50.4 | 31.3 | 2.4 | | 48.7 |

TABLE 6a. ARTIFACT ASSEMBLAGE - Floodplain Rise Sites.

| SITE NO. | FLAKES/ CHIPS | BIFACES/ CORES | LITHIC TOOLS | PECKED/ GROUND STONE | SHELL | BONE | N |
|---|---|---|---|---|---|---|---|
| Hi 51 | 68.3 | 19.2 | 3.4 | 8.5 | X | X | 57 |
| Hi 60 | 60.0 | 24.0 | 7.0 | 9.0 | X | - | 100 |
| Hi 62 | 92.0 | 5.2 | 2.6 | - | - | - | 30 |
| Hi 66 | 93.2 | 4.3 | 1.6 | 1.0 | X | - | 182 |
| Hi 69 | 67.6 | 16.1 | 12.8 | 3.2 | - | - | 31 |
| Hi 89 | 83.5 | 10.9 | 2.7 | 2.7 | X | X | 73 |
| Hi 142 | 74.5 | 6.6 | 13.6 | 2.4 | X | - | 119 |
| AVERAGE | 77.0 | 12.3 | 6.2 | 3.8 | | | |

TABLE 6b. LITHIC DEBRIS - Floodplain Rise Sites.

| SITE NO. | PRI. | SEC. | INT. | BFT | N | % FLAKES |
|---|---|---|---|---|---|---|
| Hi 51 | 30.8 | 56.4 | 12.8 | - | 39 | 69.2 % |
| Hi 60 | 15.0 | 48.3 | 36.7 | - | 60 | 78.3 |
| Hi 62 | 4.3 | 32.9 | 58.6 | 4.3 | 70 | 58.6 |
| Hi 66 | 4.7 | 40.2 | 55.0 | - | 169 | 56.8 |
| Hi 69 | 61.9 | 19.0 | 19.0 | - | 21 | 90.5 |
| Hi 89 | 1.6 | 31.1 | 67.2 | - | 61 | 73.8 |
| Hi 142 | 14.1 | 42.4 | 34.8 | 8.7 | 92 | 53.3 |
| AVERAGE | 18.9 | 38.6 | 40.6 | 1.9 | | 68.6 |

TABLE 7a. ARTIFACT ASSEMBLAGE - Base Sites.

| SITE NO. | FLAKES/ CHIPS | BIFACES/ CORES | LITHIC TOOLS | PECKED/ GROUND STONE | SHELL | BONE | N |
|---|---|---|---|---|---|---|---|
| Hi 56 | 87.2 | 5.0 | 3.6 | 2.5 | X | X | 77 |
| Hi 81 | 87.1 | 6.6 | 5.5 | 1.2 | - | - | 319 |
| Hi 82 | 87.5 | 12.4 | - | - | - | - | 32 |
| Hi 83 | 88.8 | 6.5 | 2.6 | 1.7 | - | X | 288 |
| Hi 84 | 88.6 | 6.2 | 3.4 | - | - | - | 115 |
| Hi 100 | 77.4 | 9.3 | 9.3 | 4.6 | - | - | 64 |
| Hi 106 | 55.4 | 44.3 | - | - | - | - | 36 |
| Hi 152 | 72.3 | 15.0 | 7.4 | 5.6 | - | - | 53 |
| Hi 153 | 78.8 | 14.2 | 2.3 | 1.5 | - | - | 86 |
| Hi 154 | 73.1 | 9.3 | 13.7 | 1.1 | X | X | 377 |
| AVERAGE | 79.6 | 12.8 | 4.8 | 1.8 | | | |

TABLE 7b. LITHIC DEBIRS - Base Sites.

| SITE NO. | PRI. | SEC. | INT. | BFT | N | % FLAKES |
|---|---|---|---|---|---|---|
| Hi 56 | 14.7 | 47.1 | 36.8 | 1.5 | 68 | 69.1 % |
| Hi 81 | 10.5 | 47.6 | 37.8 | 4.0 | 275 | 65.5 |
| Hi 82 | 7.1 | 46.4 | 46.4 | - | 28 | 42.9 |
| Hi 83 | 10.9 | 47.3 | 35.5 | 6.3 | 256 | 65.6 |
| Hi 84 | 4.9 | 43.1 | 46.1 | 5.9 | 102 | 64.7 |
| Hi 100 | 11.6 | 27.9 | 51.2 | 9.3 | 43 | 67.4 |
| Hi 106 | 40.0 | 40.0 | 20.0 | - | 20 | 50.0 |
| Hi 152 | 18.4 | 34.2 | 47.4 | - | 38 | 50.0 |
| Hi 153 | 16.2 | 33.8 | 50.0 | - | 68 | 44.1 |
| Hi 154 | 6.9 | 42.8 | 50.4 | - | 276 | 62.3 |
| AVERAGE | 14.1 | 41.0 | 42.2 | 2.7 | | 58.2 |

TABLE 8a. ARTIFACT ASSEMBLAGES - Slope Sites.

| SITE NO. | FLAKES/ CHIPS | BIFACES/ CORES | LITHIC TOOLS | PECKED/ GROUND STONE | SHELL | BONE | N |
|---|---|---|---|---|---|---|---|
| Hi 55 | 59.0 | 18.0 | 19.2 | 3.8 | - | - | 78 |
| Hi 79 | 67.6 | 25.6 | 5.8 | 1.4 | - | - | 136 |
| Hi 88 | 70.7 | 20.7 | 8.2 | - | X | - | 48 |
| Hi 92 | 90.0 | 4.0 | 6.0 | - | - | - | 50 |
| Hi 97 | 80.6 | 7.8 | 8.8 | 2.4 | X | - | 202 |
| Hi 98 | 89.2 | 4.1 | 4.1 | 2.3 | - | - | 476 |
| Hi 111 | 83.5 | 1.6 | 7.7 | 6.8 | - | X | 117 |
| Hi 112 | 78.7 | 8.4 | 11.2 | 1.4 | - | - | 71 |
| Hi 113 | 89.6 | 3.4 | - | 6.8 | - | - | 29 |
| Hi 115 | 67.9 | 7.2 | 19.3 | 4.1 | - | - | 82 |
| Hi 117 | 80.9 | 11.8 | 4.7 | 2.3 | X | - | 42 |
| Hi 121 | 77.9 | 17.0 | 3.6 | 1.2 | - | - | 82 |
| Hi 123 | 77.0 | 10.3 | 6.1 | 6.1 | X | - | 48 |
| Hi 125 | 59.5 | 21.1 | 11.7 | 7.4 | X | - | 94 |
| Hi 135 | 64.1 | 6.4 | 16.1 | 12.9 | X | - | 31 |
| Hi 140 | 59.9 | 16.6 | 19.0 | 6.0 | X | X | 30 |
| Hi 143 | 51.8 | 22.1 | 20.3 | 5.5 | - | - | 54 |
| AVERAGE | 73.4 | 12.1 | 10.1 | 4.1 | | | |

TABLE 8b. LITHIC DEBRIS - Slope Sites.

| SITE NO. | PRI. | SEC. | INT. | BFT | N | % FLAKES |
|---|---|---|---|---|---|---|
| Hi 55 | 30.4 | 52.2 | 17.4 | - | 46 | 78.3 % |
| Hi 79 | 15.2 | 75.0 | 9.8 | - | 92 | 59.8 |
| Hi 88 | 5.9 | 55.9 | 38.2 | - | 34 | 58.8 |
| Hi 92 | 8.9 | 46.7 | 44.4 | - | 45 | 68.9 |
| Hi 97 | 8.6 | 31.9 | 54.6 | 4.9 | 163 | 53.4 |
| Hi 98 | 8.5 | 28.5 | 51.8 | 11.3 | 425 | 60.9 |
| Hi 111 | 4.1 | 41.2 | 45.4 | 9.3 | 97 | 64.9 |
| Hi 112 | 5.4 | 30.4 | 58.9 | 5.4 | 56 | 62.5 |
| Hi 113 | 7.7 | 42.3 | 50.0 | - | 26 | 42.3 |
| Hi 115 | 8.8 | 25.0 | 58.8 | 7.1 | 56 | 53.5 |
| Hi 117 | 14.7 | 29.4 | 55.9 | - | 34 | 38.2 |
| Hi 121 | 12.5 | 40.6 | 46.9 | - | 64 | 62.5 |
| Hi 123 | 10.8 | 43.2 | 40.5 | 5.4 | 37 | 83.8 |
| Hi 125 | 14.3 | 55.4 | 30.4 | - | 56 | 73.2 |
| Hi 135 | 25.0 | 20.0 | 50.0 | 5.0 | 20 | 65.0 |
| Hi 140 | 11.1 | 55.6 | 27.8 | 5.6 | 18 | 77.8 |
| Hi 143 | 10.7 | 39.3 | 39.3 | 10.7 | 28 | 71.4 |
| AVERAGE | 11.9 | 41.9 | 42.4 | 3.8 | | 63.2 |

TABLE 9a. ARTIFACT ASSEMBLAGE - Upland Sites.

| SITE NO. | FLAKES/ CHIPS | BIFACES/ CORES | LITHIC TOOLS | GROUND/ PECKED STONE | SHELL | BONE | N |
|---|---|---|---|---|---|---|---|
| Hi 36 | 56.3 | 9.6 | 6.4 | 27.4 | - | - | 62 |
| Hi 57 | 70.8 | 20.8 | 8.1 | - | - | X | 48 |
| Hi 63 | 64.7 | 23.9 | 1.4 | 2.8 | - | - | 71 |
| Hi 102 | 86.5 | 8.9 | 3.2 | 1.0 | - | - | 268 |
| Hi 109 | 61.2 | 15.1 | 10.1 | 12.8 | - | - | 39 |
| Hi 118 | 40.0 | 20.0 | 35.0 | 5.0 | - | - | 40 |
| Hi 137 | 73.1 | 7.5 | 8.9 | 10.4 | - | - | 67 |
| Hi 139 | 70.0 | 10.8 | 14.6 | 4.6 | X | - | 130 |
| Hi 141 | 59.1 | 11.7 | 19.7 | 9.1 | X | - | 76 |
| Hi 146 | 86.1 | 8.2 | - | 5.5 | - | - | 36 |
| Hi 150 | 78.1 | 11.5 | 6.3 | 4.3 | X | - | 210 |
| Hi 151 | 85.4 | 6.1 | 8.1 | - | - | - | 49 |
| AVERAGE | 69.3 | 12.8 | 10.2 | 6.9 | | | |

TABLE 9b. LITHIC DEBRIS - Upland Sites.

| SITE NO. | PRI. | SEC. | INT. | BFT | N | % FLAKES |
|---|---|---|---|---|---|---|
| Hi 36 | 22.8 | 40.0 | 34.3 | 2.9 | 35 | 65.7 % |
| Hi 57 | 26.5 | 32.4 | 41.2 | - | 34 | 52.9 |
| Hi 63 | 28.3 | 54.3 | 17.4 | - | 46 | 67.4 |
| Hi 102 | 9.5 | 44.8 | 41.8 | 3.9 | 232 | 68.1 |
| Hi 109 | 50.0 | 29.2 | 20.8 | - | 24 | 75.0 |
| Hi 118 | 6.3 | 68.8 | 25.0 | - | 16 | 68.8 |
| Hi 137 | 4.0 | 32.6 | 55.1 | 8.1 | - | 59.2 |
| Hi 139 | 8.8 | 40.7 | 44.0 | 6.6 | 91 | 57.1 |
| Hi 141 | 19.6 | 39.1 | 41.3 | - | 46 | 65.2 |
| Hi 146 | 19.4 | 45.2 | 32.3 | 3.2 | 31 | 71.0 |
| Hi 150 | 9.8 | 38.4 | 50.6 | 1.2 | 164 | 57.3 |
| Hi 151 | 9.5 | 35.7 | 47.6 | 7.1 | 42 | 71.4 |
| AVERAGE | 17.9 | 41.8 | 37.6 | 2.8 | | 59.2 |

Comparison of artifact assemblages by microenvironment is presented in Table 10 and in Figure 6. A cursory review of the Table shows that the assemblages between zones are grossly similar. This same pattern is reflected by Table 11 and Figure 7 and can be interpreted as evidence that similar activities were carried out throughout the watershed area.

The Biface/Core category shows very little variation in percentage between zones, moreover this category is dominated by cores with few bifaces found. This may in part be due to the selective picking up of local artifact collectors and the composition of the lithic debris categories suggests that biface preparation may have been an important activity at sites along Aquilla Creek.

Pecked/Ground stone tools are primarily hammerstones (more than 75%) with some manos and an occasional metate represented. Hammerstones may have been used in the manufacture of chipped stone tools and as processing tools for vegetable foods. The scarcity of ground stone tools suggests that extensive food processing was not done with them at sites within the watershed.

The Lithic Tool category is dominated by retouched pieces while projectiles are the second most common tool. Other chipped stone artifacts include: scrapers, gravers, notches, and a gouge. The effect of artifact collecting upon these resources cannot be assessed but it must be considerable based on the known collections from sites in the area.

TABLE 10. Comparison of Lithic Assemblages from each of the microenvironmental zones.

| | FLAKES/ CHIPS | CORES/ BIFACES | LITHIC TOOLS | PECKED/GROUND STONE TOOLS |
|---|---|---|---|---|
| FLOODPLAIN | 64.4 | 13.9 | 6.0 | 13.9 |
| CREEK EDGE | 63.2 | 16.0 | 11.9 | 9.0 |
| FLOODPLAIN RISE | 77.0 | 12.3 | 6.2 | 3.8 |
| UPLAND BASE | 79.6 | 12.8 | 4.8 | 1.8 |
| UPLAND SLOPE | 73.4 | 12.1 | 10.1 | 4.1 |
| UPLAND | 69.3 | 12.8 | 10.2 | 6.9 |
| AVERAGE | 71.1 | 13.3 | 8.2 | 6.6 |

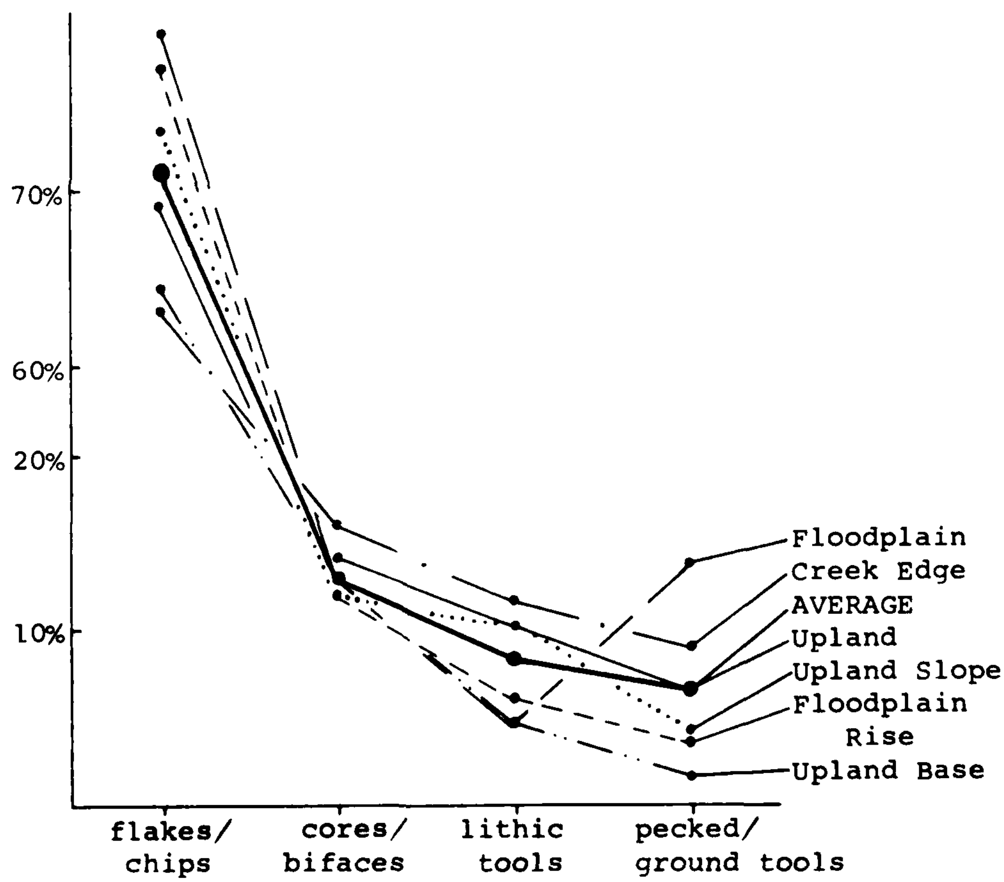


Fig. 6. Graph showing Lithic Assemblage Composition by microenvironment.

TABLE 11. Comparison of Composition of Lithic Debris Assemblages from each of the microenvironmental zones.

| | PRIMARY | SECONDARY | INTERIOR | BFT | % FLAKES |
|---|---|---|---|---|---|
| FLOODPLAIN | 7.4% | 47.2% | 42.3% | 2.3% | 66.5% |
| CREEK EDGE | 15.9 | 50.4 | 31.3 | 2.4 | 48.7 |
| FLOODPLAIN RISE | 18.9 | 38.6 | 40.6 | 1.9 | 68.6 |
| UPLAND BASE | 14.1 | 41.0 | 42.2 | 2.7 | 58.2 |
| UPLAND SLOPE | 11.9 | 41.9 | 42.4 | 3.8 | 63.2 |
| UPLAND | 17.9 | 41.8 | 37.6 | 2.8 | 64.9 |
| AVERAGE | 14.4% | 43.5% | 39.4% | 2.7% | 61.7% |

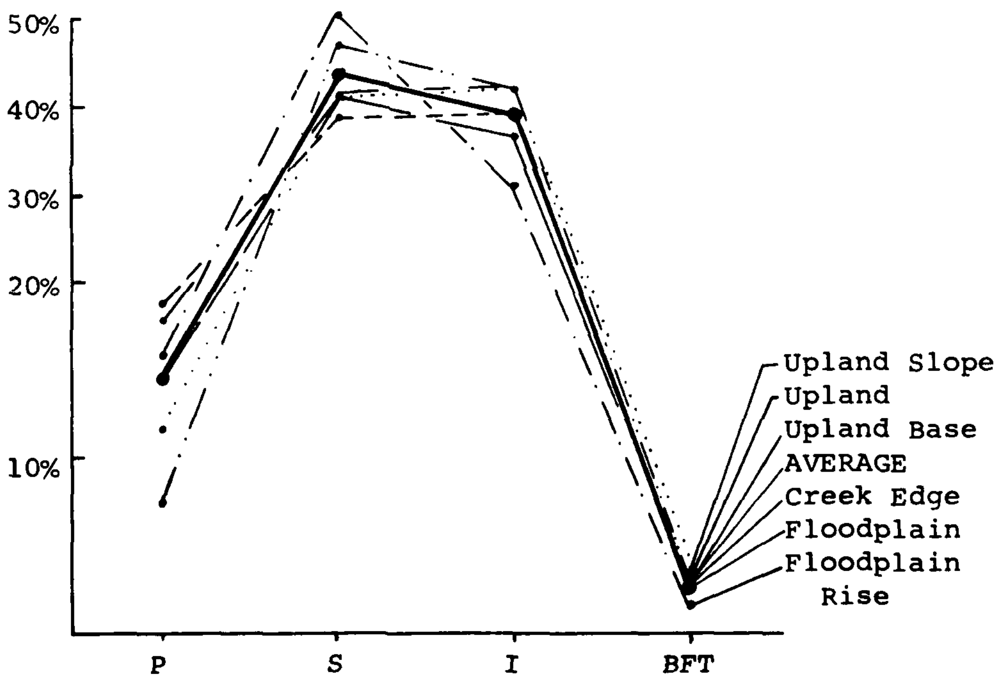


Fig. 7. Graph showing Composition of Lithic Debris by microenvironment.

## SUMMARY

This report records the results of an archaeological survey of parts of the Aquilla Creek Watershed in Central Texas. A total of 125 prehistoric sites were located and evaluated during the course of this study. The major period of prehistoric occupation was during the Late Archaic although there is evidence for occupation from about 8000 B.C. to A.D. 1500. No evidence of historic Indian campsites was found.

Analysis of the settlement patterns and the artifact assemblages suggests that the sites represent short-term campsites at which similar activities were carried out. These activities include tool manufacture, mussel shell gathering, hunting, and to a lesser extent quarrying and plant food processing. A general absence of ground stone tool fragments, especially manos and metates, is interpreted as evidence that plant food processing was not an important activity. Sites along the Brazos River alluvial terrace frequently have large numbers of ground stone tools and have been interpreted as base camps (Skinner 1971). These sites also tend to be larger in area than sites along Aquilla Creek. A similar pattern of small hunting/gathering sites being located on less permanent streams occurs at the Strawn Creek site in Navarro Mills Reservoir (Duffield 1963).

On the basis of the data presented in this report, a tentative model of the prehistoric utilization of the Aquilla Creek Watershed is proposed. The general small nature of the archaeological sites and the relative scarcity of cultural remains suggest that occupation of the watershed was for short periods of time and only for part of a year. The occurrence of temporally different projectiles at the same sites is interpreted as evidence for reoccupation of suitable camp locations. Therefore, it is suggested that prehistoric occupation of Aquilla Creek was for the purpose of specific maintenance activities carried out for short periods of time each year by small maintenance groups.

A complete maintenance cycle for the people who camped along Aquilla Creek probably involves seasonal hunting camps located on the Blackland and Grand Prairie uplands as well as more permanent base camps located within the Brazos River Valley. In order to evaluate this settlement pattern, archaeological reconnaissance will have to be conducted on the Prairie areas of Hill County.

# RECOMMENDATIONS

The archaeological survey of part of the Aquilla Creek Watershed recorded 125 prehistoric sites. Additional archaeological sites were reported by amateur archaeologists to occur on Aquilla and Hackberry Creeks upstream from the survey area. Information about these manifestations suggests that archaeological resources throughout the watershed may be temporally and functionally similar to those recorded by the survey. The investigators feel that the problems outlined above based on the survey data can be tested throughout the area.

Archaeological sites along Aquilla Creek are of a small and therefore of a fragile nature and will be easily destroyed if channelization, land clearing and flooding occur. The sites located in the Upland and Upland slope will be the first to be adversely affected by water impoundment due to wave action and the indirect action of lake utilization. Sites will be affected in all of the proposed dam sites, and therefore it is not possible to suggest that one is more favorable in terms of archaeological site destruction.

In order to mitigate the loss of archaeological resources, a program of site survey, testing and excavation is outlined below.

Phase I - Site Survey.

Additional site survey of alternative flood pool areas is necessary in order to locate and evaluate the archaeological resources which are reported to occur in the other areas. Planning for survey of these areas will need design specification similar to those available in the original documents on the Aquilla Reservoir.

Site survey needs to be completed on several parcels of land which were unavailable for study this summer. At the same time as the additional survey, several large prehistoric sites which were recorded in this

report should be surface collected using a systematic sampling procedure. An additional two months of site survey and surface collection will be needed to complete the study. With the conclusion of the site survey, a refined settlement/subsistence model might be formulated and certain modifications of the mitigation program necessitated.

Phase II - Site Testing.

An extensive program of site test pitting will be necessary in order to evaluate the relationship between surface remains and subsurface manifestations. The need for such a program has recently been exemplified by salvage excavations at Lake Whitney and at the proposed location of Cooper Lake in northeast Texas (Robert D. Hyatt, personal communication). A testing program should be part of the archaeological site survey process thereby facilitating the development of a testable model. The initial three months summer excavation program should be devoted to exploratory testing of sites. During the following nine months analysis can be completed and the initial survey model revised for testing by careful excavation.

Phase III - Site Excavation.

Until a detailed evlauation of all alternative locations has been completed, it is impossible to suggest which specific archaeological sites warrant excavation. In order to test the model proposed in the previous section, it will be necessary to excavate no fewer than two well preserved Late Archaic archaeological sites located in each of the microenvironments. Excavation would involve the development of a local chronological sequence and the clearing of living floors or occupation zones from all of these periods represented. Due to the paucity of information on the Paleo Indian, Early and Middle Archaic and the Neo-American periods, special emphasis should be placed upon isolating these components.

It is suggested that a minimum of two three-month excavation seasons, and possibly three, each followed by nine months of analysis and report preparation, will be required to accomplish the necessary excavation. The excavation crew should consist of an archaeologist, assistant archaeologist and eight or more student assistants. The archaeologist and assistant plus two students should work during the following nine months in order to do an adequate job. It is suggested that a minimum cost of $40,000 per twelve month research period (based on current prices) will be required to record the necessary archaeological data.

The archaeological sites known along Aquilla Creek represent an irretrievable historic resource which must be recorded and preserved prior to construction activities. It is our opinion that the preservation program outlined above will provide the minimum necessary to preserve an important part of the prehistory of Hill County which might otherwise be lost for future generations.

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HISTORY OF THE AQUILLA

CREEK WATERSHED

by

Wayne P. Glander

Historical surveys and reports of Hill County are to be found in the form of several books, articles, and historical manuscripts. Bailey (1966), Reese (1961) and others provide an overview of the early settlements within the county, and it is from these books and the advise of many Hill County residents that this present essay is based.

In 1849 Fort Graham was established at Jose Maria's village near the mouth of Bear Creek and the Brazos River. Roemer (1847) had visited the village in 1846 and thereby provides the earliest account of the western edge of Hill County. Establishment of the fort served as a barrier between the Indians on the west and the settlers to the east (Fig. 8). This marked a turning point which allowed for intensive and dispersed settlement within the Hill County area.

Hill County was established as a bonafide county in 1853 with Hillsboro (Hillsborough) as the county seat. Other towns included in the county at that time were Covington, Peoria, Union Bluff (Lexington), Woodbury and Patton's Mill. Of these villages, Union Bluff, Peoria, Patton's Mill and the later settlement of Aquilla are of particular interest since these historic settlements may be directly affected by construction of Aquilla Lake.

Peoria was established about 1850 on a stagecoach route which started in the western part of Hill County. The village quickly became the commerical and industrial center of Hill County during the 1870's, with a brick yard that had a capacity of some 30,000 bricks per day, and a factory for the manufacture of saddles and saddle trees.

The village of Peoria is of further interest in that it has the honor of having the first churches organized in Hill County, the Cumberland Presbyterian Church and a Methodist church. Both churches were founded in 1855. The former church was the first and still meets regularly. It was founded by Rev. John S. Patton, who also built the first church at the village of Woodbury.

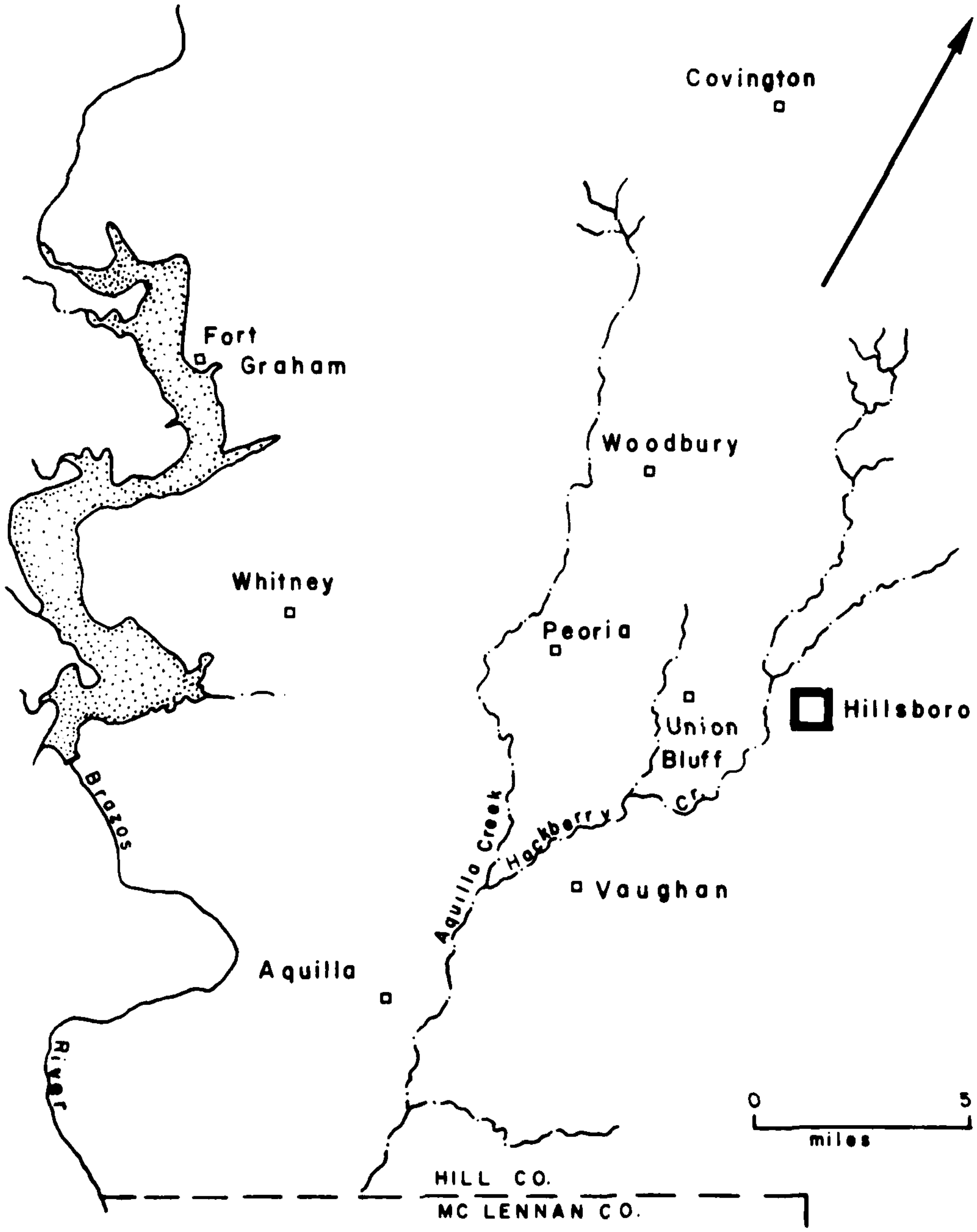


Figure 8. Location of historic townsites mentioned in text.

Peoria was incorporated in 1874 and has the distinction of having the first school in Hill County. It was a private school operated and taught by H. W. Young in the early 1850's. In 1876 another school was started by Rev. Patton which drew students from surrounding counties. The first public school was built about 1882.

Peoria's modest growth was due in part to the local water resources. Peoria, Whitney, Woodbury and other early Hill County settlements became important for settling as these areas had a watershed which almost never seemed to go dry. As long as water and wood were essential to a settlers life many of these early settlements remained important for some time. In fact, for the first thirty years Hillsboro was a village, Peoria was a larger town and could be considered the early backbone of Hill County.

As was the case with Woodbury in the 1870's, Peoria made an attempt to move the county courthouse from Hillsboro to Peoria, but the attempts failed to get the needed votes.

The Central Texas Railroad was probably the main reason for the demise of Peoria, as the railway could not buy into the village, and thus founded Whitney in 1879. Most of the residents and business establishments had moved to either Whitney or Hillsboro by 1881, the date when the latter village received the railway.

The settlement of Woodbury, located between Peoria and Covington, was founded about 1858 and was about 200 people strong by the early 1890's. Both Peoria and Covington were densely settled manufacturing centers of their time, and they were joined by a stagecoach route. Woodbury was located on this route. There was a post office, two general stores, a drug store, two blacksmith shops and a Masonic Hall in Woodbury. In 1874 the village made an effort to have the county court house moved from Hillsboro to Woodbury, but the effort was defeated.

The village of Union Bluff (Lexington) was probably

settled in late 1851 or early 1852. According to Bailey, the John Veale family settled in Hill County in 1852, and the village of Union Bluff was the nearest village to them. It is known that the first general store was opened up in 1852 by a John G. Boiles and H. Ables and Union Bluff also served as the temporary county seat until an election was held in September 1853 in which Hillsboro was chosen for the county seat.

Patton's Mill was located below Peoria on Aquilla Creek. The Rev. John S. Patton operated a mill here with a few stores being established in the early 1850's. In the 1870's it became known as Mud Town and when the Texas Central Railroad came to Hill County the people of Mud Texas moved further south along the creek and established the town of Aquilla. Thus Aquilla was the first town to move to the railroad and also the first town to change its name.

Aquilla was really the second railway town in Hill County, following Whitney. The village was a thriving railroad center during the late 1800's and the early 1900's. There were several business establishments and churches associated with the early town site, with the Baptist Church the first to be founded in 1890. Around 1890 the Masonic Lodge was organized and in 1904 the Aquilla State Bank was organized, although it was eventually liquidated in the 1920's. Fire ravaged the town in the twenties, and the town was not subsequently rebuilt.

Vaughan is located nine miles from Hillsboro, six miles from Aquilla, and six miles from Peoria. It was named for Dr. B. H. Vaughan who located in this part of the county before 1880. It was the first town to start consolidated schools.

Hillsboro was founded in 1853 as the county seat of Hill County on a donation of land by Thomas M. Steiner. By 1880 the village had a population of over 1000 people. In early 1854 the first courthouse was built which was an elm structure about twelve feet square with a dirt

floor. The building, however, was only temporary as by later that same year a new two story brick building was ready for occupancy. This courthouse building subsequently burned in 1872 with complete destruction to the building itself and the records within.

In 1874 a new courthouse was erected and it was during this period that an attempt was made to move the seat of government from Hillsboro to Woodbury. In late 1889 this courthouse was sold at auction and a fourth courthouse was to be completed the following year, this being the present building.

Hillsboro's principle reason for being was the railroad and its subsequent economic impact. In the late 1800's, the railroad company now known as the Katy (MKT), built two branches, one from Dallas to Hillsboro, and the other from Fort Worth to Hillsboro. It was this stimulus that contributed to the tremendous growth rate between 1880 and 1900. Several hundred railway workers and their families were brought into town along with a large payroll. By 1900 the population of Hillsboro was over 5,000 people.

In summary, documentary evidence has shown the location of the important towns and population centers in the Aquilla Creek area. Each of these locations is of importance to the history of Hill County and this importance has been well recognized by the Hill County Historical Survey Committee. Consequently various State Historical Survey markers have been erected in Aquilla, Peoria, Hillsboro, Jack's Branch, and elsewhere throughout the county. The concern of the people in Hill County for these important remains of their history shows that they will aid in the preservation of other historic structures which might be effected by lake constructions.

At present we are not aware of any important historic sites which will be effected by the planned construction. Several old farmsteads and log cabins were reported to occur in the study area and if they prove to be within a lake area these should be preserved. In addition it is possible that other historic locations might be

located by on-the-ground reconnaissance. In this respect it can be stated that no physical evidence of important historic sites was recorded within the area of Dam Site C but that selection of Dam Site A and B would entail the abandonment and flooding of Aquilla. If this were to happen we recommend that extended historic and archaeological investigation of Aquilla's history and physical remains be carried out before flooding occurs. Therefore, it is the recommendation of this report that a dam site other than A and B be selected for location of Aquilla Lake.

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CULTURAL EVALUATION OF THE PROPOSED

AQUILLA CREEK RESERVOIR

by

John W. McCall III

CONTENTS

## INTRODUCTION

The objectives of this study are multiple. The general aims of this report are as follows:

(1) To present the latest socio-economic data on Hill County.
(2) To present the general and specific attitudes of the people in the defined geographical area toward the proposed reservoir project.
(3) To present the economic, demographic, and geographic factors relating to these attitudes.
(4) To present the present extent and strength of water resource usage in the area.
(5) To present material on present land utilization.
(6) To present socio-economic trends after impoundment.
(7) To present all the above mentioned objectives through the use of the comparative technique based on well defined categories.

## METHOD

Three months were spent in the field collecting the material upon which this report is based, and a number of tools and techniques were employed in the collection of the data.

First a questionnaire was especially constructed to answer the specific aims.* The questionnaire was employed in two basic ways: through personal interview and through the mail.

The survey was structured around a well defined geographical area based on the location of dam site "C". The geographical area surveyed in this report is displayed on a map that can be found in the appendix of this study. All the area defined by this map was canvassed systematically, and except for the Hillsboro region an attempt was made to personally contact all households. This included

* A sample questionnaire can be seen at the back of this report.

all the small communities with populations over one hundred and all the area that will be directly or indirectly affected by the proposed Aquilla Creek Reservoir.

In Hillsboro questionnaires were mailed to six hundred households and a prepaid envelope was enclosed. Selection of recipients was carried out by taking every fourth household with a street address as it appeared in the Hillsboro Phone Directory.

Some personal interviews were conducted with several major city officials in Hillsboro. However, the main concern was with those people who live directly in or are bordered by the proposed reservoir.

A short survey was made of West, Texas but the response was poor.

The data from the questionnaires were quantified and basic relevant categories have been constructed in order that cross comparisons can be made. These categories have been founded on geographic and socio-demographic variables.

Material from county economic and census reports has been utilized wherever it was relevant.

## SOCIO-ECONOMIC BACKGROUND OF HILL COUNTY

### Population Analysis

The population of Hill County showed a steady growth through the 1910 census when it peaked at 46,760. The 1920 census depicts the first decline when the total dropped 7.3 percent to 43,332. Each succeeding census has reflected a decline; however, a leveling off is noted in the 1970 count. Hill County population totaled 22,596 in 1970. This was only 4.5 percent short of the 1960 tabulation. According to the Texas Employment Commission's report (1971), this amounted to a loss of some 105 resi-

dents per year. In the decade of the fifties, the county's population dropped 24.4 percent, or an average of 763 residents per year.

Population of Hill County

| Year | Number | Year | Number |
|---|---|---|---|
| 1860 | 3,653 | 1920 | 43,332 |
| 1870 | 7,453 | 1930 | 43,036 |
| 1880 | 16,554 | 1940 | 38,355 |
| 1890 | 27,583 | 1950 | 31,282 |
| 1900 | 41,355 | 1960 | 23,650 |
| 1910 | 46,760 | 1970 | 22,596 |

According to the 1970 Census (7,224) 31.97% was listed as urban with (15,372) 68.03% being rural. The population count per square mile was 45.14.

The vast majority of Hill County is White. The White population in 1970 composed 86.24% of the total population with the largest minority population being Black, 13.05%. These two groups compose all but .71% of the population of the county.

The largest percentage of the population of Hill County is between 18-64, 52.70%. The under eighteen age group composes 27.88% and the over sixty-five age group make up the rest, 19.85%.

## Educational Level

The average grade level for the females in Hill County is slightly higher than the male, although both groups fall below the national average. The females in the county have an average grade level of 9.5 years. The males' average grade level is 8.5. The percentage of persons fourteen and fifteen years of age enrolled in

school is 93%. This figure drops to 78.5% in the sixteen and seventeen year old age group, and it is reported that 40% who start school will never finish.

Economic Analysis *

According to the 1970 U.S. Census, there are 6,189 families in the county. From this number 48% of the families receive less than $3,000, and 55% of the housing is reported to be substandard.

Agriculture: The economy of Hill County is based on agriculture. According to sources of the publisher of The Texas Almanac, a three year average, 1965-1967, indicated that income from agriculture amounted to approximately 70% of the total income for the county.

The livestock production is chiefly cattle with the principal crops being cotton and grain, particularly maize.

The U.S. Census of Agriculture of 1964 shows that the value of farm products sold and the average per farm more than doubled from 1959 to 1964, with a percentage increase of 118.2 and 149.6% respectively.

In 1964, the value of all livestock and livestock products sold represented 58.1% of the total value of farm products sold. This compares with 31.4% in 1959. The livestock increase for this five-year period was 302.8%. Dairy products for this period rose 18.1%, while poultry and poultry products dropped by 26.9%. The value of all crops sold rose 33.5% from 1959 to 1964.

The total number of acres in Hill County is approximately 652,800. In 1959, 79.4 percent were in farms, but by 1964 the proportion in farms dropped to 76.8%.

* The majority of the economic data for this section is taken from a study completed by the Texas Employment Commission on Hill Co. in 1971.

The TEC has estimated 76% of the total county acreage to be in farms in 1971. The number of farms dropped from 2,151 in 1959 to 1,925 in 1964; the percentage drop was 10.5. The TEC estimated 1,846 farms in 1971, a decrease of 4.1% from 1964. The average size of a farm was 260.4 acres in 1964, an 8% increase over the 241.1 average size in 1959. The 1971 estimate by TEC of 268.8 acres reflects an increase of 3.2% over 1964.

According to the TEC report (1971), the area has followed the trend prevalent throughout the state - the consolidation of farms into larger units. The development and increased use of improved mechanical farm equipment enables land owners and farm operators to work additional acreage with less manual labor. These factors are reflected in farm employment in Hill County which has been gradually declining, despite increased production. The April farm employment of 2,215 in 1960 dropped to 2,035 by 1965 and to 1,770 by 1971. Agricultural self-employed and unpaid family workers in the 1971 estimate numbered 1,155. The balance of 615 were seasonal wage & salary workers.

TABLE 12 . VALUE OF FARM PRODUCTS SOLD BY SOURCE

| | 1964 | 1959 |
|---|---|---|
| All Farm Products Sold | $24,692,843 | $11,318,273 |
| Average per Farm . . | 12,827 | 5,140 |
| All Crops Sold . . . . . | 10,357,156 | 7,758,826 |
| Field Crops (Other than vegetables & fruits & nuts) . . . . . . . | 10,340,899 | 7,732,164 |
| Vegetables . . . . . . | 8,251 | 7,470 |
| Fruits & Nuts . . . . . | 3,791 | 16,427 |
| Forest Products & Horticultural Specialty Products . . . . . . | 4,215 | 2,765 |
| All Livestock & Livestock Products Sold . . . . . | 14,335,687 | 3,559,447 |
| Poultry & Poultry Products | 225,249 | 308,072 |

| | | |
|---|---|---|
| Dairy Products . . . . . | 718,358 | 608,255 |
| Livestock & Livestock Products (Other than Poultry & Dairy Products) | 13,392,080 | 2,643,120 |

SOURCE: 1964 U.S. Census of Agriculture

TABLE 13 . CASH RECEIPTS FROM THE SALE OF TEXAS FARM COMMODITIES FOR 1968, 1969, 1970.

A report of 1968, 1969, and 1970 cash receipts from the Sale of Texas farm commodities prepared by the Texas Crop & Livestock Reporting Service, U.S. Department of Agriculture, reflects the following data for Hill County.

| | 1968 (Revised) | 1969 (Revised) | 1970 1970 |
|---|---|---|---|
| -Cash Receipts from Farm Marketings- | | | |
| Crops . . . . . . . . . | 9,844 | 7,185 | 10,528 |
| Livestock & Livestock Products . . . . . | 10,002 | 12,140 | 14,446 |
| Government Payments . | 3,566 | 3,872 | 4,674 |
| Total Crops, Livestock & Government Payments | 23,412 | 23,197 | 29,648 |
| -Government Payments- | | | |
| Feed Grain Diversion & Price Support . . . | 397 | 457 | 578 |
| Wheat Diversion & Marketing Cert . . . . | 31 | 41 | 33 |
| All Cotton Price Support | 2,779 | 3,156 | 3,922 |
| Cropland Adjustment & Conversion Program | 22 | 20 | 20 |
| Soil Bank & Conservation Reserve . . . . . . | 217 | 67 | 0 |
| Wool & Mohair Program | 7 | 4 | 2 |
| Agri. Conservation Including Emergen. Conservation Measure . . . . . . | 113 | 127 | 4,119 |
| Total Government Payments | 3,566 | 3,872 | 4,674 |

TABLE 14 . HILL COUNTY FARM ESTIMATES FOR 1959, 1964, 1971.

| | 1971 (Estimate)* | 1964** | 1959** |
|---|---|---|---|
| Total Farms | 1,846 | 1,925 | 2,151 |
| Acres in Farms | 496,082 | 501,281 | 518,615 |
| Average Size of Farm | 268.8 | 260.4 | 241.1 |

* TEC estimates 1971

** U.S. Census of Agriculture

TABLE 15. HILL COUNTY CROP ACREAGE ESTIMATES FOR 1968, 1969, 1970 (Provided by the USDA Statistical Reporting Service).

| | 1968 | | 1969 | | 1970 | |
|---|---|---|---|---|---|---|
| | Planted | Harvested | Plan. | Harv. | Plan. | Harv. |
| Cotton | 76,000 | 74,500 | 86,900 | 79,700 | 89,200 | 87,400 |
| Cotton (Bales) | | 47,500 | | 26,200 | | 39,000 |
| Peanuts | | 4,800 | | 4,900 | | 4,950 |
| Pecans (Lbs.) | | 140,000* | | 11,000* | | 60,000 |
| Corn, Field | | 8,400 | | 9,700 | | 13,000 |
| Hay | | 26,130 | | 22,170 | | 25,045 |
| Oats | | 1,250 | | 7,600 | | 8,300 |
| Sorghum Grain | | 88,800 | | 79,300 | | 98,600 |
| Wheat | 8,800 | 7,700 | 15,900 | 7,600 | 4,300 | 3,300 |

TABLE 16. HILL COUNTY LIVESTOCK ESTIMATES FOR 1969, 1970, 1971 (Provided by the USDA Statistical Reporting Service).

| | Jan.1,1969 | Jan.1,1970 | Jan.1,1971 |
|---|---|---|---|
| Dairying (Milk Cows) | 2,600 | 2,800 | 2,500 |
| Goats | 1,000 | 1,000 | 1,000 |
| Sheep | 2,000 | 1,000 | 1,000 |
| Livestock (Cattle) | 65,400* | 65,200* | 70,500 |
| Poultry (Chickens Only) | 23,000 | 12,000 | 32,000 |
| Swine (Hogs) | 4,400* | 4,800 | 6,200 |

* Revised.

Nonagriculture: Nonagricultural industries in Hill County complement the area's agricultural economic base, with diversification into manufacturing and all segments of non-manufacturing.

According to the TEC report, nonagricultural employment at mid-April 1971 totaled 6,250 and represented 77.9% of total employment. This compares with 6,185 in 1970 (76.3%) and 4,895 in 1960 (68.8%). From 1960 to 1970, nonagricultural employment increased 1,290 or 26.4%, with an average of 129 new job holders per year. The April 1971 estimate reflected even a further increase of 65.

Wage & salary workers numbering 4,755 in 1971 comprised 76.1% of the nonfarm employment total. The balance were self-employed, unpaid family workers and domestic workers in private households.

Manufacturing industries employed 1,395 of the April 1971 nonfarm wage & salary worker total. Manufacturers of apparel, for both men and women, employed the largest number of workers. Textile mill products and stone, clay & glass products vie for second place in the number of manufacturing employees, followed by electrical machiner, equipment & supplies and transportation equipment. Others are: food & kindred products, furniture & fixtures and printing & publishing.

The number of workers on manufacturing payrolls in April 1970 was more than double the 1960 figure. The numerical increase of 685 amounted to a percentage gain of 117.1%. From 1970 to 1971, manufacturing employment rose by 125 or 9.8%. In 1960, manufacturing wage & salary employment of 585 represented 18% of the nonfarm wage & salary total; in 1970, the 1,270 represented 27.1%, the 1,395 represented 29.3%.

Nonmanufacturing wage & salary workers numbered 2,670 in 1960. By 1970 the number had increased 745 or 27.9%, to 3,415. From 1970 to 1971, a slight decrease of 1.6% occurred as construction dropped off. Trade and government employed the largest number, 63.9%, of the nonmanufacturing wage & salary workers

in 1960. These two groups remained in the forefront in recent estimates. Trade was up 11.7% from 1960. Government was off slightly as fewer workers were required in federal units, but growth in state and local government served to offset the loss. Services (except private households) now shares the limelight, with the significant growth identified with hospital and health care services.

An analysis of nonmanufacturing wage & salary employment for April 1971 shows percentage distribution as follows: Trade, 28.4%; Services 28.1%; Government 25%; Transportation, Communication & Utilities 7.8%; Construction 5.8%; Finance, Insurance & real Estate 3.7%; Other (Mining & Agriculture Services) 1.2%.

The self-employed, unpaid family and domestics (in private households) sectors are down from 1960.

The following table (taken from the TEC report) compares the composition of the work force in April 1960 with 1970 and 1971. The work force in counties outside Standard Metropolitan Statistical Areas is estimated annually in April. A recent monthly estimate is also provided, for October 1971; however, discussion has been held to the regular estimate period for comparative purposes. The October estimate reflects normal growth or seasonal increases in all nonagricultural industries. The increase in other nonmanufacturing reflects an atypical increase in Agricultural Service related to peak cotton harvest activities. This industry has, in the interim, dropped back to around the April, 1971 level as gains closed for the season.

TABLE 17. WORK FORCE ESTIMATES FOR HILL AND SURROUNDING COUNTIES

| | | Total | UNEMPLOYMENT | | EMPLOYMENT | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Work | | % of | | Nonfarm | | | |
| Year | County | Force | Total | Work Force | Total | Total | Mfg. | Nonmfg. | Farm |
| 1960 | Hill | 7,490 | 380 | 5.1 | 7,110 | 4,895 | 590 | 4,305 | 2,215 |
| | Bosque | 3,920 | 85 | 2.2 | 3,835 | 2,665 | 205 | 2,460 | 1,170 |
| | Limestone | 6,565 | 415 | 6.3 | 6,150 | 4,800 | 620 | 4,180 | 1,350 |
| | McLennan | 55,260 | 2,725 | 4.9 | 52,535 | 49,515 | 10,310 | 39,205 | 3,020 |
| | Navarro | 12,660 | 700 | 5.5 | 11,960 | 9,960 | 2,100 | 7,860 | 2,000 |
| | TOTAL | 85,895 | 4,305 | | 81,590 | 71,835 | 13,825 | 58,010 | 9,755 |
| 1965 | Hill | 8,250 | 380 | 4.6 | 7,870 | 5,835 | 805 | 8,030 | 2,035 |
| | Bosque | 3,935 | 165 | 4.2 | 3,770 | 2,795 | 350 | 2,445 | 975 |
| | Limestone | 6,265 | 285 | 4.5 | 5,980 | 4,935 | 600 | 4,335 | 1,045 |
| | McLennan | 58,530 | 2,375 | 4.1 | 56,155 | 53,500 | 11,135 | 42,365 | 2,655 |
| | Navarro | 13,355 | 710 | 5.3 | 12,645 | 11,020 | 2,640 | 8,380 | 1,625 |
| | TOTAL | 90,335 | 3,915 | | 86,420 | 78,085 | 15,530 | 62,555 | 8,335 |
| 1971 | Hill | 8,285 | 265 | 3.2 | 8,020 | 6,250 | 1,400 | 4,850 | 1,770 |
| | Bosque | 3,835 | 120 | 3.1 | 3,715 | 2,855 | 630 | 2,225 | 860 |
| | Limestone | 6,600 | 400 | 6.1 | 6,200 | 5,280 | 550 | 4,730 | 920 |
| | McLennan | 63,750 | 2,975 | 4.7 | 60,775 | 58,335 | 11,370 | 46,965 | 2,440 |
| | Navarro | 14,600 | 600 | 4.1 | 14,000 | 12,600 | 2,950 | 9,650 | 1,400 |
| | TOTAL | 97,070 | 4,360 | | 92,710 | 85,320 | 16,900 | 68,420 | 7,390 |

TABLE 18 . HILL COUNTY WORK FORCE.

| | April 1960 | April 1970 | April 1971 | Oct. 1971 |
|---|---|---|---|---|
| Civilian Work Force | 7,490 | 8,335 | 8,285 | 9,055 |
| Unemployed | 380 | 230 | 265 | 235 |
| Percent of Work Force | 5.1 | 2.8 | 3.2 | 2.5 |
| Total Employment | 7,110 | 8,105 | 8,020 | 8,820 |
| Agricultural | 2,215 | 1,920 | 1,770 | 2,120 |
| Nonagricultural | 4,895 | 6,185 | 6,250 | 6,700 |
| Wage & Salary Workers | 3,255 | 4,685 | 4,755 | 5,100 |
| Manufacturing | 585 | 1,270 | 1,395 | 1,435 |
| Nonmanufacturing | 2,670 | 3,415 | 3,360 | 3,665 |
| Contract Construction | 95 | 265 | 195 | 215 |
| Transportation, Communications & Utilities | 360 | 245 | 260 | 275 |
| Trade | 855 | 955 | 955 | 980 |
| Finance, Insurance & Real Estate | 100 | 110 | 125 | 130 |
| Services (exc. P.H.) | 390 | 940 | 945 | 955 |
| Government | 850 | 870 | 840 | 855 |
| Other Nonmfg. | 20 | 30 | 40 | 255 |
| Self-employed, Unpaid Family Workers | 1,240 | 1,135 | 1,130 | 1,210 |
| Domestics (in private households) | 400 | 365 | 365 | 390 |

TABLE 19 .

AVERAGE MONTHLY EMPLOYMENT AND TOTAL WAGES PAID BY EMPLOYERS SUBJECT TO THE TEXAS UNEMPLOYMENT COMPENSATION ACT*

HILL COUNTY

| Industry | 1st Quarter 1960 | | 1st Quarter 1970 | | 1st Quarter 1971 | |
|---|---|---|---|---|---|---|
| | Avg. Empl. | Total Wages | Avg. Empl. | Total Wages | Avg. Empl. | Total Wages |
| TOTAL | 1,598 | $1,081,739 | 2,977 | $3,381,949 | 3,604 | $4,182,325 |
| Contract Construction | 51 | | 273 | | 168 | |
| Manufacturing | 538 | | 1,173 | | 1,420 | |
| Transportation, Communications & Utilities | 253 | | 215 | | 229 | |
| Trade | 573 | | 701 | | 956 | |
| Services | 111 | | 477 | | 694 | |
| Other | 72 | | 138 | | 137 | |

* Not edited for corrections.

# GENERAL SURVEY ANALYSIS

## Introduction

This section is comprised of an analysis of the cultural survey conducted during the summer of 1972. It is an analysis of all the completed questionnaires combined, not individual sample comparisons. They will be discussed later in the report. It must be remembered that the response to each individual question many times varied. Therefore, each percentage is based on the number of responses to each individual question rather than the total sample size.

During the duration of this survey 956 potential respondents were contacted either through personal interview or through the mail. There were 600 contact attempts made through the mail in Hillsboro and 356 contacts (mainly personal) were attempted outside of the Hillsboro area. The number of completed questionnaires was 329 (34.41%); refusals 528 (55.23%); no contact 99 (10.36%). The phrase "no contact" means that the household was contacted personally, but no one was at home at the time the contact was attempted. The high percentage of refusals can be attributed to the low response of the mailed-out questionnaires in Hillsboro which will be discussed in the section dealing with Hillsboro. The large majority of the completed questionnaires was conducted through personal interview, 233 (70.82%); as compared to 96 (29.18%) through mail-out.

## Evaluation

The average interview time for the personal interviews was 19.6 minutes. Because of the short time duration for the completion of the questionnaire (12 min.), much of the interview time was spent in discussing questions and problems which went beyond the scope of the short answer questionnaire.

Each questionnaire was evaluated by the following questions:

1. Under what conditions was this interview conducted?

| | No | Percentage |
|---|---|---|
| A. Very relaxed, no interruptions | 210 | 90.13% |
| B. Relaxed with a few interruptions | 16 | 6.87% |
| C. Slight stress | 7 | 3.00% |
| D. Great stress with many interruptions | 0 | .00% |
| | 233 | 100.00% |

2. Did you feel that the person was sincerely interested?

| | No | Percentage |
|---|---|---|
| A. Yes | 217 | 93.13% |
| B. No | 16 | 6.87% |
| | 233 | 100.00% |

Socio-Demographic Analysis

This section of the questionnaire was completed in order to give substance to the rest of the questionnaire. It is interesting to note that the data on race, age, and education in this sample survey correlate very closely with the 1970 U.S. Census findings.

| 1. Sex: | No. | Percentage |
|---|---|---|
| Male | 184 | 55.93% |
| Female | 145 | 44.07% |
| | 329 | 100.00% |

| 2. Race | No. | Percentage |
|---|---|---|
| Caucasian | 300 | 91.19% |
| Negro | 27 | 8.21% |
| Mexican American | 2 | .60% |
| Other | 0 | .00% |
| | 329 | 100.00% |

There are relatively few young families in Hill County. Although the questionnaire was directed at the head of the household, the average age of the respondents appears to be unusually old, 55.65 years of age. If this is the case, it would then appear that the average household size would also be small. The survey does not argue with this point. The average household size was found to be 2.8 persons.

The following table is a breakdown of the respondents' ages into various categories.

| 3. Ages | No. | Percentages |
|---|---|---|
| -21 | 7 | 2.15% |
| 21-35 | 40 | 12.27% |
| 36-55 | 89 | 27.30% |
| 46-65 | 84 | 25.77% |
| 65+ | 106 | 32.52% |
| | 326 | 100.00% |

Education Analysis

The 1970 U.S. Census reported that the average level of education in Hill County is 9.0 years. This correlates closely with the survey average of 10.53 years of schooling. This slightly higher percentage is probably explained by the fact that people with very low educational levels are more apprehensive about completing a questionnaire.

Closely connected to the educational factor is the labor level. The number of Blue Collar respondents was 175 (73.84%) compared to 62 (26.16%) White Collar. Blue Collar is defined here as unskilled labor. White Collar is defined here as professional people, highly-trained technical labor, and anyone who owns his own business and whose total income is derived from this business (farms not included).

1. Number of years of schooling completed

| | No. | Percentages |
|---|---|---|
| 0-6 | 36 | 11.32% |
| 7-12 | 216 | 67.93% |
| 13-16 | 54 | 16.98% |
| 16+ | 12 | 3.77% |
| | 318 | 100.00% |

## Mobility and Sentiment Analysis

It was found that there was very little mobility among the respondents to the questionnaire. This means that the people have very strong feelings about their residence and the region in which they live and work; therefore, the people have very strong opinions about things that affect their community. The respondents to the questionnaire had lived in Texas for an average of 52.87 years, and in Hill County 39.86 years. The number of respondents owning their home was 258 (79.88%), as compared to 65 (20.12%) that rented. The average length for living in their present place of residence was 14.94 years.

1. Length of years in present place of residence

| Years | No. | Percentage |
|---|---|---|
| 0-2 | 42 | 19.72% |
| 3-10 | 72 | 33.80% |
| 11-20 | 36 | 16.90% |
| 21-30 | 33 | 15.49% |
| 31+ | 30 | 14.09% |
| | 213 | 100.00% |

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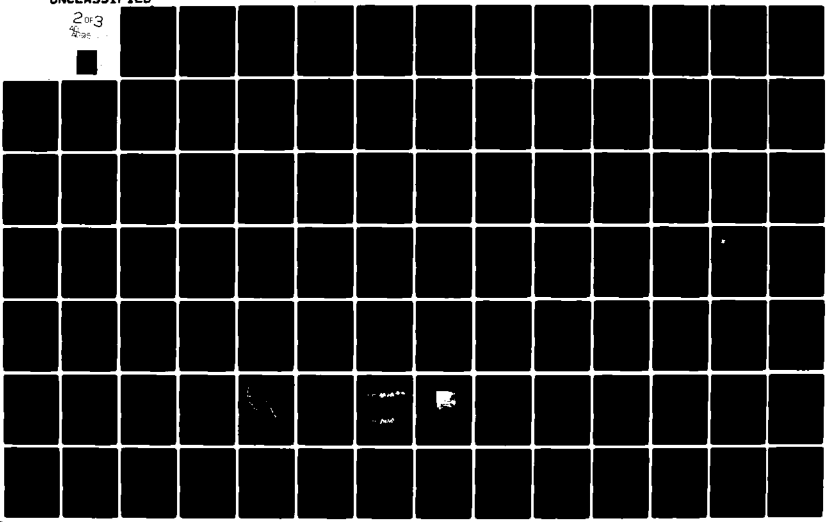

2. If you had to leave here for some reason and live somewhere else, would you miss this place?

| | No. | Percentage |
|---|---|---|
| Very much | 263 | 82.44% |
| Some | 45 | 14.11% |
| Not at all | 11 | 3.45% |
| | 319 | 100.00% |

3. Do you ever wish you did not live here?

| | No. | Percentage |
|---|---|---|
| Often | 5 | 1.56% |
| Sometimes | 31 | 9.66% |
| Seldom | 28 | 8.72% |
| Never | 257 | 80.06% |
| | 321 | 100.00% |

Project Awareness Analysis

The cognizance level plays a very important part in attitude formation. Also, the medium by which the person first learns about an innovation often affects opinion formation. Three questions were specifically constructed for this purpose: "Did you know that a lake on Aquilla Creek was being planned before you received this questionnaire?" "How long have you known?" "How did you first learn about the proposed reservoir?" In response to the first question 291 (98.23%) said that they had known before they received this questionnaire compared to 5 (1.72%) who responded that they did not know before now. The response average to the length of awareness was 4.81 years.

1. How long have you known about the proposed reservoir?

| Years | No. | Percentage |
|---|---|---|
| 0-1 | 32 | 11.00% |
| 2-3 | 94 | 32.30% |

| Years | No. | Percentage |
|---|---|---|
| 4-6 | 112 | 38.49% |
| 7-10 | 41 | 14.09% |
| 11+ | 12 | 4.12% |
| | 291 | 100.00% |

| 2. First learned about project from what source? | No. | Percentage |
|---|---|---|
| Another person | 128 | 44.14% |
| The newspaper | 126 | 43.45% |
| The radio | 27 | 9.31% |
| The television | 1 | .34% |
| Not sure | 8 | 2.76% |
| | *290 | 100.00% |

*The reason for this rather low sample response is that many of the respondents marked more than one source; therefore making the response invalid. However, the majority of the respondents that marked more than one source checked both newspaper and radio.

Reservoir Attitude Analysis

Of the 329 respondents 257 (78.12%) would be indirectly affected by the proposed Aquilla reservoir based on dam site "C", compared to 72 (21.88%) directly affected. "Indirectly affected" is defined here as anyone in the sample area that would not be forced to move or one that does not own or utilize land that would be covered or bordered by the reservoir. "Directly affected" is defined as anyone that owns or utilizes land that would be covered or bordered by the reservoir or would be forced to move because of inundation by the reservoir.

The vast majority of the respondents approved of the proposed reservoir, 275 (84.62%) approved, 46 (14.15%) disapproved, and 4 (1.23%) were neutral.

1. Degree of approval and disapproval

| | No. | Percentage of Respondents Who Approve |
|---|---|---|
| A. Approve, but it does not make that much difference to me. | 41 | 14.91% |
| B. Approve | 81 | 29.45% |
| C. Very greatly approve | 153 | 55.64% |
| | 275 | 100.00% |

(84.62% of total sample approve)

| | No. | Percentage of Respondents Who Disapprove |
|---|---|---|
| A. Disapprove, but it does not make that much difference to me | 14 | 30.43% |
| B. Disapprove | 15 | 32.61% |
| C. Very strongly disapprove | 17 | 36.96% |
| | 46 | 100.00% |

(14.15% of total sample disapproved)

| | | |
|---|---|---|
| Neutral (did not register an opinion) | 4 | 1.23% of total sample |
| | 325 Total sample number | |

The 46 respondents that disapproved did so for various reasons; 22 of the 46 said that it would cause them to sell all or part of their land or cause them to move; 10 said it would cause a friend or relative to sell or more; 3 said it would bring in undesirable people or businesses; 2 said the dam might break; 1 said there were enough lakes in the area; and 8 gave no reason.

The attitude of the respondent toward himself was elicited. The following question was asked in order to determine how much influence each individual felt he had in the community.

| 2. How much can you do to influence political decision affecting your neighborhood? | No. | Percentage |
|---|---|---|
| A. A very great deal | 16 | 5.10% |
| B. Quite a bit | 22 | 7.01% |
| C. Something | 98 | 31.21% |
| D. Can't do much | 155 | 49.36% |
| E. Can't do anything | 23 | 7.32% |
| | 314 | 100.00% |

In the attitude analysis it was also important to determine if the respondent felt that his attitude toward the proposed Aquilla Creek Reservoir represented the attitude of his entire household. Each respondent was asked the question: "Is there anyone else at this address who would express an opposite opinion from the one you hold?" The response was that 296 (97.69%) said that there was no one who would express an opposite opinion, compared to 7 (2.31%) who responded that there was someone in the household that would express an opposite opinion. Therefore this survey represents the attitudes of 595 people toward the proposed Aquilla Creek Reservoir.

## Economic and Recreational Analysis

The term "economic" is used here only in relation to the proposed reservoir. Each respondent was asked:

| 1. Do you think that the Reservoir would: | No. | Percentage |
|---|---|---|
| A. Benefit the community economically | 230 | 78.50% |
| B. Have no economic effect | 37 | 12.63% |
| C. Have a negative economic effect | 8 | 2.73% |
| D. Not sure | 18 | 6.14% |
| | 293 | 100.00% |

It is often felt that population growth is associated with economic growth; therefore, the respondents were asked if they would like to see their community increase in population. Some 313 people responded to this question, 247 (78.91%) said yes and 64 (20.48%) said no, with 2 (.61%) saying they were not sure.

In the municipal areas of Hillsboro, Peoria, and Aquilla, the respondents were asked if they felt the proposed reservoir would increase their or their family's chance for greater recreation involvement or if it would increase the community's chance for greater water recreation involvement? This question became invalid in the sampled rural area because of the nearness to the reservoir. Most people responded that they would be living next to the reservoir, or they felt they could not give a meaningful quantifiable answer. The results from the municipalities were that 26 (20.16%) said that it would increase their or their family's chance for greater recreation involvement, as compared to 103 (79.84%) who responded that it would increase the community's chance for greater recreation involvement.

In response to the question: "What lake do you most often visit in Texas?" 201 (62.04%) said Lake Whitney, 117 (36.11%) said none, and 6 (1.85%) said some other lake. The frequency was based on 2 or more visits per year. Of the respondents that stated that they visited Lake Whitney the most frequently, 42 (20.9%) also responded that they visited one or more other lakes in Texas more than twice a year. This figure (42) also represents 12.96% of all the 324 respondents to the question. The average number of visits to Lake Whitney for the 201 respondents was 16.22 times per year.

2. Number of visits per year to Lake Whitney

| | No. | Percentage |
|---|---|---|
| 2-10 | 107 | 57.22% |
| 11-20 | 38 | 20.32% |
| 21-30 | 11 | 5.88% |
| 31-50 | 25 | 13.37% |
| 51+ | 6 | 3.21% |
| | 187 | 100.00% |

The reasons for visiting the lakes are ranked in order according to importance: to fish 114, to picnic 97, to camp 33, to swim 31, to drive or walk around 30, to boat 26, to water ski 14. The respondents could give more than one reason. The response to "swimming" probably would have been much higher if it had been listed as an official reason in the questionnaire.

The proposed recreational usage of the Aquilla Reservoir is based entirely on the Hillsboro sample. The tabulations for this area appear low, because many responses had to be disallowed, since they did not give quantifiable numbers. Out of 36 responses, the projected average number of times to visit the proposed Aquilla Creek Reservoir per year was 31.19. Again the main reasons for visiting the proposed reservoir are similar to those reasons for visiting other lakes. Thirty respondents stated that they would go there to fish; 30 also to picnic; 14 to boat; 11 to camp, 7 to water ski, 3 to drive or walk around.

3. Projected number of visits per year to the proposed Aquilla Creek Reservoir

| Projected number of visits per year to the proposed Aquilla Creek Reservoir | No. of Respondents | Percentage |
|---|---|---|
| 2-10 | 19 | 52.78% |
| 11-20 | 4 | 11.11% |
| 21-30 | 5 | 13.89% |
| 31-50 | 2 | 5.56% |
| 51+ | 6 | 16.67% |
| | 36 | 100.00% |

The survey shows that the respondents are very much aware of their water resources and the need for water. Only one respondent in the entire sample of 329 respondents was not aware of where his source of drinking water originated. The respondents were also asked why they thought another reservoir had been proposed for this region. Only 25 of the respondents said that they were not sure. The other respondents usually stated one or more reasons. Seventy-seven respondents expressed that they thought the proposed reservoir was to provide more water and camping recreation outlets

for the region. One hundred and eighty-six respondents stated that it was to provide a greater source of drinking and industrial water for this region, and one hundred and ten said that it was to help bring more business and industry into the area. Fifty-eight respondents gave flood control as a reason, with two stating that it was only to allow the soil conservation service to make money.

Land Utilization Analysis

The land utilization analysis for this survey very closely correlates to the findings already given in this study as reported by the TEC (1971). Some 42.25% of all the respondents in this survey owned or leased five or more acres of land. The total number of acreage of farm land for the 139 respondents that owned or leased five or more acres was 31,499 acres. This means that the average farm of the respondents was 226.61 acres. This compares to the TEC's report of 268.8 acres average per farm in Hill County.

1. Number of acres owned or leased

| Acres | No. of Respondents | Percentage |
|---|---|---|
| 5-50 | 21 | 15.11% |
| 51-100 | 37 | 26.62% |
| 101-200 | 41 | 29.50% |
| 201-500 | 25 | 17.99% |
| 501+ | 15 | 10.78% |
| | 139 | 100.00% |

The amount of land leased to someone else is 3,585 acres (11.38%) or the total amount of land. The respondents were asked to state their main cash crop or crops (if the acreage for each was evenly split). In the survey region cotton was still the main producer, 5672 acres (18.01%). Maize was second with 3761 acres (11.94%). Peanuts accounted for 198 acres (.60%). This means that 29.95% of the land is planted in either cotton or maize. Some 2107 cattle were sold

per year per farm. In the survey region there were four dairy farms.

2. What percentage of your total income is derived from your farm?

| What percentage of your total income is derived from your farm? | No. of Respondents | Percentage |
|---|---|---|
| Less than 1/4 | 41 | 32.54% |
| 1/4 | 30 | 23.81% |
| 1/2 | 14 | 11.11% |
| 3/4 | 8 | 6.35% |
| All | 33 | 26.19% |
| | 126 | 100.00% |

INDIRECTLY AND DIRECTLY AFFECTED SURVEY ANALYSIS

## Introduction*

In this section of the report the directly affected respondents have been compared with the indirectly affected respondents in relation to dam site "C". As previously stated, "directly affected" is defined here as anyone who owns or leases land that would be covered or bordered by the reservoir, or anyone who would be forced to move because of inudation by the reservoir. "Indirectly affected" is defined here as anyone who does not own or lease land that would be covered or bordered by the reservoir and would not be forced to move because of inudation by the reservoir.

There were 257 (78.12%) of the respondents that will be indirectly effected based on dam site "C". One hundred and sixty-three (63.42%) of the questionnaires were completed through personal interview as compared to 94 (36.58%) completed by mail.

There were 72 (21.88%) of the respondents who will be directly affected by the proposed reservoir. Of these, 70 (97.22%) were interviewed personally, compared to 2 (2.28%) who were interviewed by mail.

## Evaluation**

1. Under what conditions was this interview conducted?

| | Directly Affected | | Indirectly Affected | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Very relaxed, no interruptions | 64 | 91.43 | 146 | 89.57% |
| Relaxed with a few interruptions | 4 | 5.71 | 12 | 7.36% |
| Slight stress | 2 | 2.86 | 5 | 3.07% |
| Great stress with many interruptions | 0 | .00 | 0 | .00% |
| | 70 | 100.00% | 163 | 100.00% |

*The percentages in this section are based on the number of responses to each question rather than the entire sample universe.

**For explanations of individual questions see relevant topic under the General Survey section in this report.

2. Did you feel that the respondent was sincerely interested?

| | Directly | | Indirectly | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Yes | 148 | 90.80% | 69 | 98.57% |
| No | 15 | 9.20% | 1 | 1.43% |
| | 163 | 100.00% | 70 | 100.00% |

3. Average interview time — 21.86 min. — 18.63 min.

Socio-Demographic Analysis

1. Sex:

| | Directly | | Indirectly | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Male | 52 | 58.33% | 142 | 55.25% |
| Female | 20 | 41.67% | 115 | 44.75% |
| | 72 | 100.00% | 257 | 100.00% |

2. Race:

| | | | | |
|---|---|---|---|---|
| Caucasian | 52 | 77.22% | 248 | 96.50% |
| Negro | 20 | 27.78% | 7 | 2.72% |
| Mexican American | 0 | .00% | 2 | .78% |
| Other | 0 | .00% | 0 | .00% |
| | 72 | 100.00% | 257 | 100.00% |

Note the very high percentage of Negros that will be directly affected in comparison to the indirectly affected.

The average age of the respondents for the two groups is roughly the same: 55.79 years for the directly affected group, and 55.61 years for the indirectly affected group. The average number of residence per household among the respondents was 2.69 persons for the directly affected broup and 2.83 for the indirectly affected group.

3. Ages in years

| | | | | |
|---|---|---|---|---|
| -21 | 2 | 2.78% | 5 | 1.97% |
| 21-35 | 7 | 9.72% | 33 | 12.99% |

| | Directly | | Indirectly | |
|---|---|---|---|---|
| | No. | % | No. | % |
| 36-55 | 23 | 31.94% | 66 | 25.98% |
| 56-65 | 20 | 27.78% | 64 | 25.20% |
| 65+ | 20 | 27.78% | 86 | 33.86% |
| | 72 | 100.00% | 254 | 100.00% |

## Education Analysis

The average level of schooling for the directly affected area is 10.4 years of schooling compared to 10.57 years of schooling for the indirectly affected group.

1. Educational level by number of years of schooling

| | Directly Affected | | Indirectly Affected | |
|---|---|---|---|---|
| Years | No. | % | No. | % |
| 0-6 | 6 | 8.57% | 30 | 12.10% |
| 7-12 | 54 | 77.14% | 162 | 65.32% |
| 13-16 | 10 | 14.29% | 44 | 17.74% |
| 16+ | 0 | .00% | 12 | 4.84% |
| | 70 | 100.00% | 248 | 100.00% |

2. Labor:

| | | | | |
|---|---|---|---|---|
| Blue Collar | 46 | 82.14% | 129 | 71.27% |
| White Collar | 10 | 17.86% | 52 | 28.73% |
| | 56 | 100.00% | 181 | 100.00% |

## Mobility and Sentiment Analysis

The residential stability factor for both groups appears to be about the same. Both groups place high sentimental values on their place of residence. The average length of time lived in Texas for the directly affected group was found to be 52.96 years compared to 52.84 for the indirectly affected group. The average length of time spent in Hill County for the indirectly affected group was 40.40 years. For the directly affected group this was slightly lower 38 years.

Although both groups seem to express high sentiment values toward their place of residence, there does appear to be some difference between the two groups, as indicated by the figures. Some 63 (87.5%) of the respondents in the directly affected groups owned their own homes compared to 195 (77.69%) of the respondents in the indirectly affected area that own their homes. Nine (12.5%) of the directly affected group rent compared to 56 (22.31%) of the indirectly group that rent their homes. The average length of time spent in their present place of residence was 14.49 years for the directly affected group and 15.13 years for the indirectly affected group.

1. Length of years in present place of residence

| | Directly | | Indirectly | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Years | | | | |
| 0-2 | 9 | 13.85% | 33 | 22.30% |
| 3-10 | 24 | 36.92% | 48 | 32.43% |
| 11-20 | 16 | 24.62% | 20 | 13.51% |
| 21-30 | 8 | 12.31% | 25 | 16.89% |
| 31+ | 8 | 12.31% | 22 | 14.87% |
| | 65 | 100.00% | 148 | 100.00% |

2. If you had to leave here for some reason and live somewhere else would you miss this place?

| | | | | |
|---|---|---|---|---|
| Very much | 68 | 94.44% | 195 | 78.95% |
| Some | 3 | 4.17% | 42 | 17.00% |
| Not at all | 1 | 1.39% | 10 | 4.05% |
| | 72 | 100.00% | 247 | 100.00% |

3. Do you ever wish you did not live here?

| | | | | |
|---|---|---|---|---|
| Often | 0 | .00% | 5 | 2.01% |
| Sometimes | 3 | 4.17% | 28 | 11.25% |
| Seldom | 1 | 1.39% | 27 | 10.84% |
| Never | 68 | 94.44% | 189 | 75.90% |
| | 72 | 100.00% | 249 | 100.00% |

This difference in sentimental values can only be conjectured. The higher feeling of sentiment toward the place of residence among the directly affected group might be attributed to the fact that this group felt a higher sentiment rating would cause them to receive a higher price for their land.

Project Awareness Analysis

All 72 (100%) of the directly affected respondents said that they had known about the proposed Aquilla Creek Reservoir before now. This compares to 5 (2.19%) of the indirectly affected respondents who stated that they did not know about the proposed reservoir before now. The directly affected group also responded that they had known about the project for an average of 6.32 years. This average was close to two years longer than the indirectly affected group whose average length of awareness was 4.35 years.

1. How long have you known about the proposed reservoir?

| | Directly | | Indirectly | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Years | | | | |
| 0-1 | 1 | 1.47% | 31 | 13.90% |
| 2-3 | 14 | 20.59% | 80 | 35.87% |
| 4-6 | 34 | 50.00% | 78 | 34.98% |
| 7-10 | 12 | 17.65% | 29 | 13.01% |
| 11+ | 7 | 10.29% | 5 | 2.24% |
| | 68 | 100.00% | 223 | 100.00% |

2. First learned about reservoir from what source?

| | Directly | | Indirectly | |
|---|---|---|---|---|
| Another person | 28 | 42.42% | 100 | 44.64% |
| The newspaper | 34 | 51.52% | 92 | 41.07% |
| The radio | 4 | 6.06% | 23 | 10.27% |
| The television | 0 | .00% | 1 | .45% |
| Not sure | 0 | .00% | 8 | 3.57% |
| | 66 | 100.00% | 224 | 100.00% |

## Reservoir Attitude Analysis

In the directly affected group 44 (61.11%) approved, 27 (37.50%) disapproved of the proposed reservoir, and 1 (1.39%) remained neutral. The approval rate among the indirectly affected group was much higher as would be expected: 231 (91.30%) approved of the proposed reservoir; 19 (7.50%) disapproved, and 3 (1.20%) were neutral.

| 1. Degree of approval and disapproval | Directly | | Indirectly | |
|---|---|---|---|---|
| | No. | % | No. | % |
| (Approve) | | | | |
| Approve, but it does not make that much difference to me. | 4 | 9.09% | 37 | 16.02% |
| Approve | 14 | 31.82% | 67 | 29.00% |
| Very greatly approve | 26 | 59.09% | 127 | 54.98% |
| | 44 | 100.00% | 231 | 100.00% |
| (Disapprove) | | | | |
| Disapprove, but it does not make that much difference to me. | 4 | 14.81% | 10 | 52.63% |
| Disapprove | 8 | 29.63% | 7 | 36.84% |
| Very strongly disapprove | 15 | 55.56% | 2 | 10.53% |
| | 27 | 100.00% | 19 | 100.00% |

Among the respondents that disapproved in the directly affected group, 22 of the 27 disapproved because it would cause them to move or sell their land. Three said it would cause a friend to sell land, and three said that they disapproved because the reservoir would bring in undesirable people and businesses. One said that there were enough lakes in the region.

Among the indirectly affected group, seven disapproved because it would cause a friend or relative to move or

sell land; one responded that it would bring in undesirable people and businesses, and that there were already enough lakes in the region. Another respondent said that the reservoir would create more tornados.

2. How much can you do to influence political decisions affecting your neighborhood?

| | Directly No. | Directly % | Indirectly No. | Indirectly % |
|---|---|---|---|---|
| A very great deal | 3 | 4.29% | 13 | 16.02% |
| Quite a bit | 9 | 12.86% | 13 | 16.02% |
| Something | 22 | 31.42% | 76 | 31.15% |
| Can't do much | 34 | 48.56% | 121 | 49.59% |
| Can't do anything | 2 | 2.86% | 21 | 8.60% |
| | 70 | 100.00% | 244 | 100.00% |

3. Is there anyone else at this address who would express an opposite opinion from the one you hold?

| | Directly No. | Directly % | Indirectly No. | Indirectly % |
|---|---|---|---|---|
| Yes | 1 | 1.47% | 6 | 2.55% |
| No. | 67 | 98.53% | 229 | 97.45% |
| | 68 | 100.00% | 235 | 100.00% |

Economic and Recreational Analysis

1. Do you think that the Reservoir would-

| | Directly No. | Directly % | Indirectly No. | Indirectly % |
|---|---|---|---|---|
| Benefit the community economically | 50 | 73.53% | 180 | 80.00% |
| Have no economic effect | 13 | 19.12% | 24 | 10.66% |
| Have a negative economic effect | 2 | 2.94% | 6 | 2.67% |
| Not sure | 3 | 4.41% | 15 | 6.67% |
| | 68 | 100.00% | 225 | 100.00% |

2. Would you like to see this community increase in population?

| | Directly No. | Directly % | Indirectly No. | Indirectly % |
|---|---|---|---|---|
| Yes | 50 | 72.46% | 197 | 80.47% |
| No | 19 | 27.54% | 45 | 18.44% |
| | 69 | 100.0C% | 244 | 100.00% |

3. What lake in Texas do you most often visit?

| | Directly No. | Directly % | Indirectly No. | Indirectly % |
|---|---|---|---|---|
| Whitney | 40 | 56.00% | 161 | 63.88% |
| Other | 0 | 00.00% | 6 | 2.38% |
| None | 32 | 44.00% | 85 | 33.73% |
| | 72 | 100.00% | 252 | 100.00% |

The above Table is based on two or more visits per year. Among those respondents directly affected, 7 (17.5%) of those respondents that visit Whitney also visit some other lake in Texas as well. This compares to 35 (21.74%) of the indirectly affected group that also visit some other lake in Texas as well as Whitney.

4. Number of visits per year to Lake Whitney

| | Directly No. | Directly % | Indirectly No. | Indirectly % |
|---|---|---|---|---|
| 2-10 | 23 | 57.50% | 84 | 57.14% |
| 11-20 | 12 | 30.00% | 26 | 17.69% |
| 21-30 | 1 | 2.50% | 10 | 6.80% |
| 31-50 | 3 | 7.50% | 22 | 14.97% |
| 51+ | 1 | 2.50% | 5 | 3.40% |
| | 40 | 100.00% | 147 | 100.00% |

All of the directly affected group knew where their source of drinking water originated and only one respondent in the indirectly affected said he did not know. Both groups visited the lakes for the same main reason. These reasons rank in the same order as they do in the General Survey Analysis section of this report.

The two groups both responded that the main reason another reservoir had been proposed for this region was to provide a greater source of drinking and industrial water. The second most important reason was to help bring more business and industries into the area. The directly affected group felt that flood control was the third most important reason whereas the indirectly affected group felt that to provide more water and camping recreation outlets was the third most important reason. The directly affected group ranked water and camping recreation fourth and the indirectly affected group gave flood control as the fourth largest reason.

Inundation Land Analysis

This part of the Analysis involves only the directly affected respondents in this report.

Of the 72 respondents classified as directly affected, 51 respondents said that they owned land that would be covered by the proposed Aquilla Creek Reservoir. However, 9 of the respondents in this group gave no quantifiable amount of land that would be covered by the proposed reservoir. Fifty of the 72 respondents stated that they had land that would be bordered by the reservoir, but 13 of the 50 respondents in this group gave no quantifiable amount to be bordered. The term "bordered" is defined here, as any land that is owned or leased that would directly join the lake front.

The total amount of land to be covered by the proposed reservoir is 5050 acres. This is an average of 120.24 acres per respondent who stated that he had land that would be covered. The average amount bordered would be 94.70 per respondent or a total of 3504 acres. (The above figures in this section are based entirely on the figures reported by each respondent. There was no effort made to validate any of the figures. Most of the respondents stated that these were the figures given to them by the surveyors at the time they were surveying their land).

1\. The amount of land directly affected (Directly affected group only)

| Acres | Covered No. | Covered % | Bordered No. | Bordered % |
|---|---|---|---|---|
| 1-10 | 4 | 9.52% | 2 | 5.41% |
| 11-50 | 16 | 38.10% | 15 | 40.54% |
| 51-100 | 9 | 21.43% | 12 | 32.43% |
| 101-200 | 8 | 19.05% | 4 | 10.81% |
| 201-500 | 3 | 7.14% | 3 | 8.11% |
| 501+ | 2 | 4.76% | 1 | 2.70% |
| | 42 | 100.00% | 37 | 100.00% |
| Not Sure | 9 | | 13 | |
| Total | 51 | | 50 | |

Land Utilization Analysis

Among the directly affected group 87.5% stated in a quantifiable amount that they owned or leased five or more acres. This compares to 29.57% for the indirectly affected group. The difference in figures can be attributed to the number of "urban" dwellers in the indirectly affected group. The average amount of acreage owned between the two groups can also be attributed to this factor. The average amount of land owned or leased by the directly affected group was 268.81 acres per respondent; compared to 191.63 acres per respondent in the indirectly affected group.

1\. Number of acres owned or leased

| Acres | Directly No. | Directly % | Indirectly No. | Indirectly % |
|---|---|---|---|---|
| 5-50 | 7 | 11.11% | 14 | 18.42% |
| 51-100 | 16 | 25.40% | 21 | 27.63% |
| 101-200 | 18 | 28.57% | 23 | 30.26% |
| 201-500 | 14 | 22.22% | 11 | 14.48% |
| 501+ | 8 | 12.70% | 7 | 9.21% |
| | 63 | 100.00% | 76 | 100.00% |

Among the directly affected group 2398 acres (14.16%) of the land is leased to someone else; compared to 1187 (8.15%) for the indirectly affected group. The major crops grown among both groups are maize and cotton.

(The following figures are based on the question: What major crop or crops are put into cultivation? Give amount cultivated in Acres.). The average amount of land cultivated in maize and cotton among the directly affected group is 13.11% of a total of 2221 acres for maize and 20.12% of a total of 3408 acres in cotton. This means that 5629 acres (33.24%) of the land is cultivated in cotton and maize. The indirectly affected group put 1540 (10.58%) of its land in maize and 2264 (15.55%) of the land into cotton; or 26.13% of the land into maize and cotton. The directly affected group sells an average of 1231 head of cattle per year or 19.54 head per farm. The indirectly affected group sells 876 head of cattle a year or 11.53 head per farm per year. There are four dairy farms in the directly affected group.

2. What % of your total income is derived from your farm?

| | Directly | | Indirectly | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Less than 1/4 | 19 | 31.15% | 22 | 33.85% |
| 1/4 | 14 | 22.95% | 16 | 24.62% |
| 1/2 | 7 | 11.48% | 7 | 10.77% |
| 3/4 | 2 | 3.28% | 6 | 9.23% |
| All | 19 | 31.15% | 14 | 21.54% |
| | 61 | 100.00% | 65 | 100.00% |

## AQUILLA, PEORIA, AND HILLSBORO SURVEY ANALYSIS

### Introduction

This section is a comparison of the three closest communities to the proposed Aquilla Creek Reservoir, with populations exceeding a 100 persons, Aquilla, Peoria, and Hillsboro, Texas. The location and relationship to the proposed reservoir was based on dam site "C" can be seen on the map found at the back of this report.

## AQUILLA

### Description

Aquilla is a small community consisting of about 200 people. The town of Aquilla can best be described as a town of the aged. Only five of the thirty-eight heads of the households interviewed were under forty-five. The youngest couple in the town are in their early twenties. The majority of the people in Aquilla are retired. Everyone that lives in the town was either born or reared in or near Aquilla, or married someone who had the preceding characteristics. All but one family in Aquilla was Caucasian. This family was a Negro family.

Outside of government paychecks, the economics of the town is composed of two food stores, two gasoline stations, and one cotton gin. Ever since the early thirties the town has slowly decreased in size. The town attributes this to fires, the loss of train service, a decrease in interest in cotton, and to the fact that it is no longer on a main highway. They all talk of times past when Aquilla was a boom town. However the majority of the people state that they would like to see the town grow in population. They feel that the proposed Aquilla Creek Reservoir will help achieve this aim.

The Aquilla High School in Aquilla serves the educational needs of the people within the community and

the surrounding area. There are three active churches in the town to care for the spiritual needs of the people.

## History

The history of the three communities is taken from the book written by Ellis Bailey entitled A History of Hill County, Texas 1839-1965.

According to Mr. Bailey the town of Aquilla was first called Patton Mill, and it was organized before Hill County became an official county. After the Civil War, the name Patton Mill was dropped and the place was called Mud Town, probably in jest of the always muddy streets. Mr. Bailey says that this name stuck until the Texas Central Railroad built in the county. Whitney became the first railroad town and Mud Town was the first town to change its name when it moved. It was changed to its still present name of Aquilla. The townsite was purchased from H.P. Harris. One of the first businessmen to move to Aquilla was E.R. Boyd, who with his brother-in-law, J.E. Ballard, owned a grocery store.

There was much sickness in Aquilla because of the water supply. Water had to be hauled from Harris Spring or from Aquilla Creek in barrels. In 1897 an artesian well was dug, and because of its perpetual motion flow, water could be piped into the homes and businesses.

About 1890 a Masonic Lodge was organized at Aquilla, and at one time the town was incorporated with a mayor and several aldermen. However, after six years the corporation was voted out. Also in 1890, the first church was organized in Aquilla. It was a Baptist Church, which was closely followed by a Methodist and Christian Church.

In 1904 the Aquilla State Bank was organized. The bank was later sold to Citizens National Bank of Hillsboro and was liquidated during the late 1920's.

From 1905 until about 1909 Aquilla had no brick buildings, but at one time the town of Aquilla is said to have boasted 750 people. (Bailey 1966, pp. 44-46).

Method

There was an attempt to contact all households in Aquilla, 36 (83.72%) of the respondents completed the questionaire with only 7 (16.28%) being classified as no contact. Thirty-five of the 36 completed questionaires through personal interview or (79.22%). One (2.78%) was completed by mail. Thirty-four (94.44%) of the respondents fell into the indirectly affected classification with only 2 (5.56%) being classed as directly affected.

## PEORIA

Introduction

Peoria is a small community located between Hillsboro and Whitney, Texas on Highway 22. Its population is even smaller than that of Aquilla, and over the past couple of decades it too, has been slowly losing population. However the majority of the people feel that the proposed Aquilla Creek Reservoir would reverse this trend.

The economics of the town consist of two food-gasoline station stores; one small auto mechanic ship; and a stock car race track which is located just outside of town on Highway 22.

History

According to Mr. Bailey, Peoria was started about 1850 when a stagecoach route was formed in the western part of the county. Peoria had its greatest economic boom during the 1870's when there were ten stores, a saloon, and a blind tiger. It became the commercial and industrial center of Hill County with a brick yard that had a capacity of 30,000 bricks per day and a factory that manufactured saddles.

Peoria had the honor of having the first churches organized in Hill County. The Cumberland Presbyterian Church was the first organized church in the county, with the Methodist being second. Both were organized in 1855.

Peoria was incorporated in 1874 for school purposes. At one time in the 1870's Peoria was larger than Hillsboro, and because of this an election was held about moving the courthouse to Peoria from Hillsboro; however it was defeated by a few votes. Prior to this Peoria had invested in 240 acres of land in preparation of the courthouse change.

However the prosperity of Peoria did not last long because in 1879 the railroad was built through Hill County by-passing Peoria. When the railroad was built through Hillsboro in 1881, most of the remaining businesses and residences moved to Hillsboro (Bailey pp. 37-39).

### Method

All twenty-two completed questionnaires in Peoria can be attributed to the personal interview method. Each household in Peoria was contacted and 22 (75.87%) were completed; there were 3 (10.34%) no contacts, and 4(13.79%) that refused to complete the questionnaire. Twenty-one (95.45%) were classed as indirectly affected and 1 (4.55%) was classed as being directly affected.

## HILLSBORO

### Introduction

Hillsboro is a centrally located community off interstate 35 between Dallas and Waco. The city of Fort Worth also lies just fifty miles to the north. Hillsboro is a community of approximately 9,900, although the 1970 U.S. Census has it estimated at 7,224. It is the county seat of Hill County and derives most of its income from agricultural products and light

industry which has increased steadily in the past decade. In the ninteen fifties the population dropped 11.4%, or an average loss of 95 persons per year. The recent 1970 census places Hillsboro's population at 7,224, only a slight 2.4% under the 1960 count. However the city estimates the present population at 9,650 which would mean a growth rather than a loss over the past decade.

Hillsboro receives two local newspapers, the "Daily Mirror" and the "Reporter." It has adequate fire and police service for its size. The educational facilities on both the secondary and junior college level are good, and the banking system in Hillsboro is large for its size. It has a progressive Chamber of Commerce, city management, and other service organizations.

History

The town of Hillsboro was started in 1853, as the county seat of Hill County on a donation of land by Thomas M. Steiner. Hillsboro obtained a town charter in 1883, and from 1880 until 1897 the population of Hillsboro grew extensively. The 1880 census showed that 1,125 people lived in Hillsboro. The greatest one thing contributing to the growth was the railroad and the railroad shops located at Hillsboro. The population by 1890 had grown to 5,346.

On June 6, 1883 the first fire company was organized at Hillsboro, the hook and ladder company. On Sept. 17, 1885 the engine company was formed and on Oct. 24, 1885 the fire department was organized. A house was built on South Waco Street where the post office now stands. In 1909 the fire department moved to its present location and in 1913 the department bought a truck and became the first motorized fire department in Texas.

The first public school was built in 1886 at a cost of $12,000. The junior college was started in 1923, and in 1925 it was admitted to the Association of Texas Colleges and in 1927 to the American Association of Junior Colleges.

## Method

Six-hundred standard questionnaire forms were mailed in Hillsboro. This was based on a sample drawn from the Hillsboro City Telephone Directory of every fourth person. All of the respondents considered in this sample completed the questionnaire by mail. Although several extensive interviews were conducted with city officials, they were not considered part of the sample unless they appeared as a selected respondent in the Directory. Only 93 (15.5%) of the 600 mailed questionnaires were completed. Ninety-one (97.85%) fell into the indirectly affected category with 2 (2.15%) falling into the directly affected category.

## Evaluation*

1. Under what conditions was this interview conducted?

| | Aquilla | | Peoria | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Very relaxed, no interruptions | 28 | 80.00% | 21 | 95.45% |
| Relaxed with a few interruptions | 5 | 14.29% | 1 | 4.55% |
| Slight Stress | 2 | 5.71% | 0 | 0.00% |
| Great stress with many interruptions | 0 | .00% | 0 | .00% |
| | 35 | 100.00% | 22 | 100.00% |

* The percentages in this section are based on the number of responses to each individual question rather than the entire sample universe. The town of Hillsboro is not considered in the evaluation section because all questionnaires were completed by mail; therefore there could be no personal evaluation by the interviewer.
For explanations of individual questions see relevant topic under the General Survey section in this report.

2. Did you feel that the respondent was sincerely interested?

| | | | | |
|---|---|---|---|---|
| Yes | 30 | 85.71% | 19 | 86.36% |
| No | 5 | 14.29% | 3 | 13.64% |
| | 35 | 100.00% | 22 | 100.00% |

3. Average interview time: 23.77 min. 17.50 min.

Socio-Demographic Analysis

| | Hillsboro | | Aquilla | | Peoria | |
|---|---|---|---|---|---|---|
| 1. Sex | No. | % | No. | % | No. | % |
| Male | 53 | 56.99 | 12 | 33.33 | 13 | 59.09% |
| Female | 40 | 43.01 | 24 | 66.67 | 9 | 40.91% |
| | 93 | 100.00 | 36 | 100.00 | 22 | 100.00% |
| 2. Race: | | | | | | |
| Caucasian | 88 | 94.62 | 35 | 97.22 | 22 | 100.00% |
| Negro | 4 | 4.30 | 1 | 2.78 | 0 | .00% |
| Mex.Amer. | 1 | 1.08 | 0 | .00 | 0 | .00% |
| Other | 0 | .00 | 0 | .00 | 0 | .00% |
| | 93 | 100.00 | 36 | 100.00 | 22 | 100.00% |

In Aquilla the majority of the respondents were female and in the other two communities the majority of respondents were male.

In the second Table it is interesting to see that the highest percentage of Negro respondents were from the much larger community of Hillsboro.

Aquilla had the oldest average age per respondent, 59.14 years; Hillsboro was second, 57.88 years and Peoria was the youngest 55.55 years. The average number of persons per household for the three groups was 2.56 for Hillsboro, 2.58 for Aquilla and 2.59 for Peoria.

3. Ages in years

| | Hillsboro | | Aquilla | | Peoria | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| -21 | 1 | 1.10 | 0 | .00 | 0 | .00% |
| 21-35 | 7 | 7.69 | 4 | 11.00 | 5 | 22.73% |
| 36-55 | 28 | 30.77 | 8 | 22.22 | 5 | 22.73% |
| 56-65 | 21 | 23.08 | 9 | 25.00 | 5 | 22.73% |
| 65+ | 34 | 37.36 | 15 | 41.67 | 7 | 31.81% |
| | 91 | 100.00 | 36 | 100.00% | 22 | 100.00% |

Education Analysis

The respondents in Hillsboro had a much higher average in the number of years of schooling completed. The average respondent in Hillsboro had completed an average of 12.55 years of schooling. This compares to Aquilla's average of 9.36 and Peoria's average of 9.18 years of schooling. However the higher educational level of Hillsboro might be attributed to the fact that only those respondents with a higher level of formal education completed the questionnaire.

1. Educational level by number of years of schooling.

| | Hillsboro | | Aquilla | | Peoria | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Years | | | | | | |
| 0-6 | 2 | 2.27 | 6 | 16.67 | 5 | 22.73% |
| 7-12 | 50 | 56.82 | 25 | 69.44 | 16 | 72.73% |
| 13 16 | 27 | 30.68 | 5 | 13.89 | 1 | 4.54% |
| 16+ | 9 | 10.23 | 0 | .00 | 0 | .00% |
| | 88 | 100.00 | 36 | 100.00 | 22 | 100.00 |

2. Labor:

| | | | | | | |
|---|---|---|---|---|---|---|
| Blue Collar | | | | | | |
| | 24 | 39.34 | 29 | 80.56 | 13 | 81.25% |
| White Collar | | | | | | |
| | 37 | 60.66 | 7 | 19.94 | 3 | 18.75% |
| | 61 | 100.00 | 36 | 100.00 | 16 | 100.00% |

As would be expected the largest percentage of White Collar workers can be found in Hillsboro.

## Mobility and Sentiment Analysis

The average length of time lived in Texas by the Hillsboro respondents was 53.7 years; 57.44 years for the Aquilla respondents, and 53.77 years for the Peoria group. The average length of time spent in Hill County per respondent was 42.43 years for Hillsboro, 44.64 years for Aquilla, and 44.36 years for Peoria.

In Hillsboro 77 (84.61%) of the respondents who completed the questionnaire owned their own homes compared to 14 (15.39%) who rented. In Aquilla 30 (83.33%) of the respondents owned their homes compared to 6 (16.67%) that rented. In Peoria 22 (100%) of the respondents that completed the questionnaire owned their own homes. The average respondent in Aquilla had lived in his present place of residence for 14.72 years; for Peoria this figure was 12.55 years. Since this question was not asked to the Hillsboro sample, no figures can be given on this topic.

1. Length of years in present place of residence:

| | Aquilla | | Peoria | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Years | | | | |
| 0-2 | 5 | 15.63 | 5 | 25.00% |
| 3-10 | 12 | 37.50 | 7 | 30.00% |
| 11-20 | 8 | 25.00 | 4 | 20.00% |
| 21-30 | 3 | 9.37 | 1 | 5.00% |
| 31+ | 4 | 12.50 | 3 | 15.00% |
| | 32 | 100.00 | 20 | 100.00% |

2. If you had to leave here for some reason and live somewhere else would you miss this place?

| | Hillsboro | | Aquilla | | Peoria | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Very much | 67 | 74.44 | 29 | 80.56 | 20 | 90.90% |
| Some | 20 | 22.22 | 7 | 19.44 | 1 | 4.55% |
| Not at all | 3 | 3.34 | 0 | .00 | 1 | 4.55% |
| | 90 | 100.00 | 36 | 100.00 | 22 | 100.00% |

3. Do you ever wish you did not live here?

| | Hillsboro No. | % | Aquilla No. | % | Peoria No. | % |
|---|---|---|---|---|---|---|
| Often | 4 | 4.44 | 0 | .00 | 0 | .00% |
| Sometimes | 15 | 16.67 | 6 | 16.67 | 1 | 4.55% |
| Seldom | 16 | 17.78 | 2 | 5.56 | 2 | 9.09% |
| Never | 55 | 61.11 | 28 | 77.87 | 19 | 86.36% |
| | 90 | 100.00 | 36 | 100.00 | 22 | 100.00% |

There appears to be more discontent with place of residence among the Hillsboro respondents than among either the Aquilla or Peoria respondents.

Project Awareness Analysis

Hundred percent of the Aquilla and Peoria respondents said that they had known about the project before they received this questionnaire; however there were 3 respondents out of 73 persons that responded to the question in Hillsboro that were not aware of the proposed Aquilla Creek Reservoir before now. The Hillsboro respondents had known about the proposed reservoir for an average of 3.06 years. This average was higher for both Aquilla and Peoria. The Aquilla respondents said that they had known about the proposed reservoir for an average of 5.71 years and the Peoria respondents said they had known for an average of 5.19 years. This is more than an average of two years longer for the two smaller communities.

1. How long have you known about the proposed reservoir?

| Years | Hillsboro No. | % | Aquilla No. | % | Peoria No. | % |
|---|---|---|---|---|---|---|
| 0-1 | 16 | 22.86 | 3 | 8.82 | 1 | 4.55% |
| 2-3 | 34 | 48.57 | 12 | 35.29 | 4 | 18.18% |
| 4-6 | 17 | 24.28 | 12 | 35.29 | 11 | 50.00% |
| 7-10 | 2 | 2.86 | 5 | 14.71 | 5 | 22.73% |
| 11+ | 1 | 1.43 | 2 | 5.88 | 1 | 4.55% |
| | 70 | 100.00 | 34 | 100.00 | 22 | 100.00% |

2. First learned about reservoir from what source?

| Another | Hillsboro No. | % | Aquilla No. | % | Peoria No. | % |
|---|---|---|---|---|---|---|
| Person | 32 | 49.23 | 16 | 47.06 | 10 | 45.45% |
| Newspaper | 24 | 36.92 | 17 | 50.00 | 7 | 31.82% |
| Radio | 7 | 10.77 | 1 | 2.94 | 4 | 18.18% |
| Television | 0 | .00 | 0 | .00 | 0 | .00% |
| Not sure | 2 | 3.08 | 0 | .00 | 1 | 4.55% |
| | 65 | 100.00 | 34 | 100.00 | 22 | 100.00% |

Reservoir Attitude Analysis

Among the Hillsboro respondents 85 (93.41%) approved of the proposed Aquilla Creek Reservoir; 5 (5.49%) disapproved; and 1 (1.10%) remained neutral on the subject. Among the Aquilla respondents 28 (77.80%) approved of the proposed reservoir and 8 (22.20%) disapproved. In Peoria the approval rate was 20 (90.91%) among the respondents and 2 (9.09%) that disapproved of the proposed reservoir.

1. Degree of approval and disapproval

| | Hillsboro No. | % | Aquilla No. | % | Peoria No. | % |
|---|---|---|---|---|---|---|
| (Approve) | | | | | | |
| Approve, but it does not make that much difference to me. | 11 | 12.94 | 8 | 28.57 | 3 | 15.00% |
| Approve | 22 | 25.88 | 7 | 25.00 | 7 | 35.00% |
| Very greatly approve | 52 | 61.18 | 13 | 46.43 | 10 | 50.00% |
| | 85 | 100.00 | 28 | 100.00 | 20 | 100.00% |
| (Disapprove) | | | | | | |
| Disapprove, but it does not make that much difference to me | 4 | 80.00 | 3 | 37.50 | 2 | 100.00% |

| | Hillsboro No. | Hillsboro % | Aquilla No. | Aquilla % | Peoria No. | Peoria % |
|---|---|---|---|---|---|---|
| Disapprove | 0 | .00 | 3 | 37.50 | 0 | .00% |
| Very greatly disapprove | 1 | 20.00 | 2 | 25.00 | 0 | .00% |
| | 5 | 100.00 | 8 | 100.00 | 2 | 100.00% |

2. How much can you do to influence political decisions affecting your neighborhood?

| | Hillsboro No. | Hillsboro % | Aquilla No. | Aquilla % | Peoria No. | Peoria % |
|---|---|---|---|---|---|---|
| A very great deal | 7 | 8.24 | 1 | 2.78 | 2 | 9.09% |
| Quite a bit | 8 | 9.41 | 2 | 5.56 | 1 | 4.55% |
| Something | 37 | 43.54 | 11 | 30.56 | 4 | 18.18% |
| Can't do much | 25 | 29.41 | 18 | 50.00 | 14 | 4.55% |
| Can't do anything | 8 | 9.41 | 4 | 11.11 | 1 | 4.55% |
| | 85 | 100.00 | 36 | 100.00 | 22 | 100.00% |

3. Is there any one else at this address who would express an opposite opinion from the one you hold?

| | Hillsboro No. | Hillsboro % | Aquilla No. | Aquilla % | Peoria No. | Peoria % |
|---|---|---|---|---|---|---|
| Yes | 3 | 3.75 | 1 | 2.78 | 0 | .00% |
| No | 77 | 96.25 | 35 | 97.22 | 21 | 100.00% |
| | 80 | 100.00 | 36 | 100.00 | 21 | 100.00% |

<u>Economic and Recreational Analysis</u>

1. Do you think that the Reservoir would:

| | Hillsboro No. | Hillsboro % | Aquilla No. | Aquilla % | Peoria No. | Peoria % |
|---|---|---|---|---|---|---|
| Benefit the community economically | 62 | 84.93 | 19 | 67.86 | 17 | 80.96% |
| Have no economic effect | 9 | 12.33 | 7 | 25.00 | 1 | 4.76% |

Have a negative economic effect

| | Hillsboro | | Aquilla | | Peoria | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| | 1 | 1.37 | 2 | 7.14 | 1 | 4.76% |
| Not sure | 1 | 1.37 | 0 | .00 | 2 | 9.52% |
| | 73 | 100.00 | 28 | 100.00 | 21 | 100.00% |

2. Would you like to see this community increase in population?

| | Hillsboro | | Aquilla | | Peoria | |
|---|---|---|---|---|---|---|
| Yes | 84 | 95.45 | 35 | 97.22 | 14 | 66.67% |
| No | 4 | 4.55 | 1 | 2.78 | 7 | 33.33% |
| | 88 | 100.00 | 36 | 100.00 | 21 | 100.00% |

Each group was asked, "How large would you like to see this community?" In Hillsboro the optimum population size was reported to be 25,700.

3. Population preference for Hillsboro

| | Hillsboro | |
|---|---|---|
| Thousands | No. | % |
| 10-20 | 32 | 64.00% |
| 21-50 | 15 | 30.00% |
| 51-100 | 3 | 6.00% |
| | 50 | 100.00% |

Among the Aquilla respondents the average optimum population size was reported to be 3,235 with five respondents saying they would like to see it get just as large as it could.

4. Population preference for Aquilla

| | Aquilla | |
|---|---|---|
| | No. | % |
| Hundreds | | |
| 200-500 | 3 | 12.00% |
| 501-1,000 | 8 | 32.00% |
| 1001-3,000 | 7 | 28.00% |
| 3001+ | 7 | 28.00% |
| | 25 | 100.00% |

Among the Peoria respondents the average optimum population size was reported to be 3,370.

5. Population preference for Peoria

| Hundreds | Peoria No. | Peoria % |
|---|---|---|
| 150-200 | 1 | 10.00% |
| 201-500 | 1 | 10.00% |
| 501-1,000 | 3 | 30.00% |
| 1001-2,000 | 3 | 30.00% |
| 2001+ | 2 | 20.00% |
| | 10 | 100.00% |

6. What lake in Texas do you most often visit?

| | Hillsboro No. | Hillsboro % | Aquilla No. | Aquilla % | Peoria No. | Peoria % |
|---|---|---|---|---|---|---|
| Whitney | 66 | 74.16 | 26 | 72.22 | 12 | 54.55% |
| Other | 2 | 23.59 | 1 | 2.78 | 0 | .00% |
| None | 21 | 2.25 | 9 | 25.00 | 10 | 45.45% |
| | 89 | 100.00 | 36 | 100.00 | 22 | 100.00% |

The above Table is based on two or more visits per year. Among the Hillsboro respondents that visit Lake Whitney two or more times a year, 17 (25.76%) stated that they also visit some other lake in Texas two or more times a year. In Aquilla 6 (23.08%) of the respondents that visit Lake Whitney visit some other lake also, and in Peoria this figure is 4 (33.33%).

7. Number of visits per year to Lake Whitney

| | Hillsboro No. | Hillsboro % | Aquilla No. | Aquilla % | Peoria No. | Peoria % |
|---|---|---|---|---|---|---|
| 2-10 | 38 | 62.30 | 14 | 70.00 | 1 | 8.33% |
| 11-20 | 11 | 18.03 | 3 | 15.00 | 6 | 50.00% |
| 21-30 | 3 | 4.92 | 2 | 10.00 | 1 | 8.33% |
| 31-50 | 8 | 13.11 | 1 | 5.00 | 4 | 33.34% |
| 51+ | 1 | 1.64 | 0 | .00 | 0 | .00% |
| | 61 | 100.00 | 20 | 100.00 | 12 | 100.00% |

All three groups knew where their source of drinking water originated and the respondents in each group visited the lakes for the same main reason. These reasons rank in the same order as they do in the General Survey Analysis section of this report.

All three communities responded that the main resson another reservoir had been proposed for the region was to provide a greater source of drinking and industrial water. The second most important reason for all three groups of respondents was to help bring more business and industries into the area. However the Hillsboro group felt that the third most important reason was to provide more water and camping recreation outlets for the region; whereas Aquilla and Peoria felt that the third most important reason was to provide flood control on Aquilla Creek.

The following two questions were only recorded for the Hillsboro respondents because it was felt that the questions became invalid for the Aquilla and Peoria group for reasons already stated in the "Directly and Indirectly Affected Survey" section of this report.

8. Projected number of visits per year to the Aquilla Creek Reservoir

| | Hillsboro No. | % |
|---|---|---|
| 2-10 | 2 | 51.35% |
| 11-20 | 4 | 10.81% |
| 21-30 | 5 | 13.51% |
| 31-50 | 2 | 5.41% |
| 51+ | 7 | 18.92% |
| | 37 | 100.00% |

9. Do you think that the proposed reservoir would:

| | | |
|---|---|---|
| Increase families chance for greater recreation involvement | 18 | 19.35% |

Increase communities chance for greater recreation involvement

| | | |
|---|---|---|
| | 75 | 80.65% |
| | 93 | 100.00% |

The main reasons given for visiting the proposed Aquilla Creek Reservoir is for fishing and picnicing.

Land Utilization Analysis

Among the Hillsboro respondents 14 (16.13%) owned or leased five or more acres of land, and in Aquilla this figure was 5 (13.89%) compared to Peoria's 5 (22.73%). However Aquilla had the largest average farm acreage per respondent that owned or leased five or more acres. The average farm in Aquilla was 402.2 acres per respondent compared to 141 acres for Peoria and 275.93 acres for Hillsboro. In Aquilla 650 acres (32.32%) of the farm land was leased to someone else. In Peoria 160 acres (22.77%) was leased and in Hillsboro 471 acres (12.19%) of the farm land was leased based on the quantifiable responses given by the respondents.

1. Number of acres owned or leased

| | Hillsboro | | Aquilla | | Peoria | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Acres | | | | | | |
| 5-50 | 3 | 21.43 | 1 | 20.00 | 1 | 20.00% |
| 51-100 | 2 | 14.29 | 0 | .00 | 0 | .00% |
| 101-200 | 3 | 21.43 | 1 | 20.00 | 4 | 80.00% |
| 201-500 | 4 | 28.56 | 2 | 40.00 | 0 | .00% |
| 501+ | 2 | 14.29 | 1 | 20.00 | 0 | .00% |
| | 14 | 100.00 | 5 | 100.00 | 5 | 100.00% |

2. % of total income derived from farm:

| | | | | | | |
|---|---|---|---|---|---|---|
| Less than 1/4 | 4 | 30.77 | 1 | 33.33 | 1 | 25.00% |
| 1/4 | 5 | 38.47 | 0 | .00 | 2 | 50.00% |
| 1/2 | 2 | 15.38 | 2 | 66.67 | 1 | 25.00% |
| 3/4 | 2 | 15.38 | 0 | .00 | 0 | .00% |
| All | 0 | .00 | 0 | .00 | 0 | .00% |
| | 13 | 100.00 | 3 | 100.00 | 4 | 100.00% |

## URBAN AND RURAL SURVEY ANALYSIS

### Introduction

This section of the report compares the urban respondents that completed the questionnaire with the rural respondents. The term "urban" is defined here as all respondents that completed the questionnaire and live either in the community of Hillsboro, Aquilla, or Peoria. The term "rural" is defined here as all other respondents that did not fall into the above category.*

In the rural area 178 (62.68%) of the people contacted completed the questionnaire; 89 (31.34%) were listed as "no contact;" and 17 (5.98%) were listed as refusals. Of the completed questionnaires 176 (98.88%) were completed by personal interview and 2 (1.12%) were completed by mail.

Among the urban group 151 (22.47%) of the people contacted completed the questionnaire. This seemingly low percentage can be attributed to the low return of the 600 mailed questionnaires in the Hillsboro region. Of the 151 completed questionnaires in this group, 57 (37.75%) were completed through personal interview and 94 (62.25%) were completed by mail. From the total contacts of 672, 10 (1.49%) were listed as "no contact;" and 511 (76.04%) were listed as refusals.

One-hundred fifty-one (45.9%) of the sample respondents were urban and 178 (54.1%) of the sample were rural.

*These defined areas can be seen on the map in the appendix section.

Evaluation*

1. Under what conditions was this interview conducted?

| | Urban No. | % | Rural No. | % |
|---|---|---|---|---|
| Very relaxed, no interruptions | 49 | 85.96 | 161 | 91.48% |
| Relaxed with a few interruptions | 6 | 10.53 | 10 | 5.68% |
| Slight Stress | 2 | 3.51 | 5 | 2.84% |
| Great stress with many interruptions | 0 | .00 | 0 | .00% |
| | 57 | 100.00 | 176 | 100.00% |

2. Did you feel that the respondent was sincerely interested?

| | Urban No. | % | Rural No. | % |
|---|---|---|---|---|
| Yes | 49 | 85.96 | 168 | 95.45% |
| No | 8 | 14.04 | 8 | 4.55% |
| | 57 | 100.00 | 176 | 100.00% |

3. Average interview time: 21.35 min. 19.03 min.

Socio-Demographic Analysis

1. Sex:

| | Urban No. | % | Rural No. | % |
|---|---|---|---|---|
| Male | 78 | 51.66 | 106 | 59.55% |
| Female | 73 | 48.34 | 72 | 40.45% |
| | 151 | 100.00 | 178 | 100.00% |

2. Race:

| | Urban No. | % | Rural No. | % |
|---|---|---|---|---|
| Caucasian | 145 | 96.03 | 174 | 97.75% |
| Negro | 5 | 3.31 | 3 | 1.69% |
| Mex. Amer. | 1 | .66 | 1 | .56% |
| Other | 0 | .00 | 0 | .00% |
| | 151 | 100.00 | 178 | 100.00% |

*The percentages in this section are based on the number of responses to each individual question rather than the entire sample universe. For explanations of individual questions see relevant topic under the General Survey section in this report.

The average age of the urban respondents was 57.84 years and the rural respondents was 53.81 years.

3. Ages in years

| | Urban | | Rural | |
|---|---|---|---|---|
| | No. | % | No. | % |
| -21 | 1 | .66 | 6 | 3.39% |
| 21-35 | 16 | 10.74 | 24 | 13.56% |
| 36-55 | 41 | 27.52 | 48 | 27.12% |
| 56-65 | 35 | 23.49 | 49 | 27.68% |
| 65+ | 56 | 37.59 | 50 | 28.25% |
| | 149 | 100.00 | 177 | 100.00% |

The average number of persons per household for the urban respondents was 2.57 and 3.22 for the rural respondents.

4. Education Analysis

As would be expected the average number of years of schooling for the urban respondents was much higher than among the rural respondents. The average number of years of schooling for the urban respondents was 11.25 years. The average number of years of schooling for the rural group was 9.22.

1. Educational level by number of years of schooling

| | Urban | | Rural | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Years | | | | |
| 0-6 | 13 | 8.91 | 23 | 13.38% |
| 7-12 | 91 | 62.33 | 125 | 72.67% |
| 13-16 | 33 | 22.60 | 21 | 12.21% |
| 16+ | 9 | 6.16 | 3 | 1.74% |
| | 146 | 100.00 | 172 | 100.00% |

2. Labor:

| | | | | |
|---|---|---|---|---|
| Blue Collar | 66 | 58.41 | 109 | 87.90% |
| White Collar | 47 | 41.59 | 15 | 12.10% |
| | 113 | 100.00 | 124 | 100.00% |

## Mobility and Sentiment Analysis

The average length of time lived in Texas by the urban respondents was 54.61 years compared to 51.39 years for the rural group. For the average time spent in Hill County the statistics did not vary. The rural respondents had lived in Hill County an average of 37.01 years and the urban respondents had lived in the county an average of 43.26 years.

Some 129 (74.14%) of the rural respondents said that they owned their own home, whereas 45 (25.86%) rented. For the urban group the percentage was even higher for those respondents that owned their own home, 129 (86.58%) compared to 20 (13.42%) that rented.

1. Length of years in present place of residence:

| | Urban* | | Rural | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Years | | | | |
| 0-2 | 10 | 19.23 | 32 | 19.88% |
| 3-10 | 19 | 36.54 | 53 | 32.92% |
| 11-20 | 12 | 23.08 | 24 | 14.91% |
| 21-30 | 4 | 7.69 | 29 | 18.00% |
| 31+ | 7 | 13.46 | 23 | 14.29% |
| | 52 | 100.00 | 161 | 100.00% |

2. If you had to leave here for some reason and live somewhere else would you miss this place?

| | | | | |
|---|---|---|---|---|
| Very much | 116 | 78.38 | 147 | 85.97% |
| Some | 28 | 18.92 | 17 | 9.94% |
| Not at all | 4 | 2.70 | 7 | 4.09% |
| | 148 | 100.00 | 171 | 100.00% |

*The percentages in Table number one does not include the Hillsboro respondents.

3. Do you ever wish you did not live here?

| | Urban | | Rural | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Often | 4 | 2.70 | 2 | .58% |
| Sometimes | 22 | 14.87 | 9 | 5.20% |
| Seldom | 20 | 13.51 | 8 | 4.62% |
| Never | 102 | 68.92 | 155 | 89.60% |
| | 148 | 100.00 | 173 | 100.00% |

The percentages for these two groups in the preceding section seem to be typical of most urban-rural situations.

Project Awareness Analysis

Only one of 172 rural respondents was not cognizant of the proposed Aquilla Creek Reservoir, and only 3 (2.33%) of the urban respondents were not aware of the proposed reservoir before they received the questionnaire.

The urban respondents had known about the proposed reservoir for an average of 4.07 years. This average was higher for the rural respondents with an average of 4.98 years.

1. How long have you known about the proposed reservoir?

| | Urban | | Rural | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Years | | | | |
| 0-1 | 20 | 15.87 | 12 | 8.45% |
| 2-3 | 50 | 39.68 | 41 | 28.87% |
| 4-6 | 40 | 31.75 | 61 | 42.96% |
| 7-10 | 12 | 9.52 | 23 | 16.20% |
| 11+ | 4 | 3.18 | 5 | 3.52% |
| | 126 | 100.00 | 139 | 100.00% |

2. First learned about reservoir from what source?

| | Urban | | Rural | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Another person | 58 | 47.93 | 70 | 40.68% |
| The newspaper | 48 | 39.67 | 78 | 45.35% |
| The radio | 12 | 9.92 | 15 | 8.35% |
| The television | 0 | .00 | 1 | .60% |
| Not sure | 3 | 2.48 | 8 | 4.65% |
| | 121 | 100.00 | 172 | 100.00% |

Reservoir Attitude Analysis

Among the urban respondents 133 (89.26%) approved of the proposed reservoir; 15 (10.07%) disapproved and 1 (.67%) remained neutral on the subject. Of the rural respondents 142 (79.78%) approved while 33 (18.54%) disapproved and 3 (1.68%) remained neutral.

1. Degree of approval and disapproval

| | Urban | | Rural | |
|---|---|---|---|---|
| | No. | % | No. | % |
| (Approve) | | | | |
| Approve, but it does not make that much difference to me. | 22 | 16.54% | 19 | 13.38% |
| Approve | 36 | 27.07% | 45 | 31.69% |
| Very greatly approve | 75 | 56.39% | 78 | 54.93% |
| | 133 | 100.00% | 142 | 100.00% |
| (Disapprove) | | | | |
| Disapprove, but it does not make that much difference to me. | 9 | 60.00% | 5 | 15.15% |
| Disapprove | 3 | 20.00% | 12 | 36.36% |

| | Urban | | Rural | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Very greatly disapprove | 3 | 20.00% | 16 | 48.49% |
| | 15 | 100.00% | 33 | 100.00% |

2. How much can you do to influence political decisions affecting your neighborhood?

| | Urban No. | Urban % | Rural No. | Rural % |
|---|---|---|---|---|
| A very great deal | 10 | 6.99% | 6 | 3.51% |
| Quite a bit | 11 | 7.69% | 11 | 6.43% |
| Something | 52 | 36.36% | 46 | 26.90% |
| Can't do much | 57 | 39.86% | 98 | 57.31% |
| Can't do anything | 13 | 9.10% | 10 | 5.85% |
| | 143 | 100.00% | 171 | 100.00% |

3. Is there anyone else at this address who would express an opposite opinion from the one you hold?

| | Urban | | Rural | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Yes | 4 | 2.92% | 3 | 1.78% |
| No | 133 | 97.08% | 166 | 98.22% |
| | 137 | 100.00% | 169 | 100.00% |

Economic and Recreational Analysis

1. Do you think the Reservoir would:

| | Urban No. | Urban % | Rural No. | Rural % |
|---|---|---|---|---|
| Benefit the community economically | 98 | 80.33% | 132 | 77.19% |
| Have no economic effect | 17 | 13.93% | 20 | 11.70% |

| | Urban No. | Urban % | Rural No. | Rural % |
|---|---|---|---|---|
| Have a negative economic effect | 4 | 3.28% | 4 | 2.34% |
| Not sure | 3 | 2.46% | 15 | 8.77% |
| | 122 | 100.00% | 171 | 100.00% |
| 2. Would you like to see this community increase in population? | | | | |
| Yes | 133 | 91.72% | 114 | 68.67% |
| No | 12 | 8.28% | 52 | 31.33% |
| | 145 | 100.00% | 166 | 100.00% |
| 3. What lake in Texas do you most often visit? | | | | |
| Whitney | 104 | 70.75% | 97 | 54.80% |
| Other | 3 | 2.04% | 3 | 1.70% |
| None | 40 | 27.21% | 77 | 43.50% |
| | 147 | 100.00% | 177 | 100.00% |

The above Table is based on two or more visits per year. Among the urban respondents that visit lake Whitney two or more times a year 27 (25.96%) stated that they also visit some other lake in Texas two or more times a year. Of the rural respondents that visit lake Whitney two or more times a year 15 (15.46%) said that they visit some other lake in Texas as well. The average number of visits per respondent for the rural group to Lake Whitney is 15.40 times per year and 17.04 for the urban respondents.

| 4. Number of visits per year to lake Whitney | Urban No. | Urban % | Rural No. | Rural % |
|---|---|---|---|---|
| 2-10 | 53 | 56.99% | 54 | 57.45% |

| | Urban No. | Urban % | Rural No. | Rural % |
|---|---|---|---|---|
| 11-20 | 20 | 21.51% | 18 | 19.15% |
| 21-30 | 6 | 6.45% | 5 | 5.32% |
| 31-50 | 13 | 13.98% | 12 | 12.76% |
| 51+ | 1 | 1.07% | 5 | 5.32% |
| | 93 | 100.00% | 94 | 100.00% |

One hundred percent of the urban respondents knew where their source of water originated, and only 1 (.56%) of the rural respondents was not aware where his source of water originated.

Both groups felt that the most important reason the Aquilla Reservoir had been proposed was to provide a greater source of drinking and industrial water for the region. The second most important reason the reservoir had been proposed was to bring more business and industry into the area. The third most important reason was for more water and camping recreation outlets and the fourth reason was for flood control.

Land Inundation Analysis

Of the rural respondents 50 (28.09%) have land that will be inundated by the reservoir and 46 (25.84%) own or lease land that will be bordered. Only 1.32% of the urban respondents own or lease land that will be inundated by the reservoir and only 3.31% have land that will be bordered by the proposed reservoir, based on dam site "C." The average amount of land that would be covered by the proposed reservoir of the rural group that will be directly affected is 117.14 acres covered and 97.74 acres bordered.

1. Amount to be covered or bordered (assesment of rural respondents only)

| Acres | Covered No. | Covered % | Uncovered No. | Uncovered % |
|---|---|---|---|---|
| 0-10 | 4 | 9.52% | 2 | 5.71% |
| 11-50 | 16 | 38.10% | 14 | 40.00% |
| 51-100 | 9 | 21.43% | 11 | 31.43% |

| Acres | Covered No. | Covered % | Uncovered No. | Uncovered % |
|---|---|---|---|---|
| 101-200 | 8 | 19.05% | 4 | 11.43% |
| 201-500 | 3 | 7.14% | 3 | 8.57% |
| 501+ | 2 | 4.76% | 1 | 2.86% |
| | 42 | 100.00% | 35 | 100.00% |

Land Utilization Analysis

Among the urban respondents 24 (15.90%) owned or leased five or more acres. This compared to 116 (64.78%) of the respondents in the rural group that owned or leased more than 5 acres. However the average size farm owned by the urban respondent was larger than that of the rural respondent; 274.13 acres average for the urban respondent, and 219.31 acres average for the rural respondent.

1. Number of acres owned or leased

| Acres | Urban No. | Urban % | Rural No. | Rural % |
|---|---|---|---|---|
| 5-50 | 5 | 20.84% | 16 | 13.79% |
| 51-100 | 2 | 8.33% | 35 | 30.17% |
| 101-200 | 8 | 33.33% | 33 | 28.45% |
| 201-500 | 6 | 25.00% | 20 | 17.24% |
| 501+ | 3 | 12.50% | 12 | 10.35% |
| | 24 | 100.00% | 116 | 100.00% |

The rural respondent leased an average of 21.59 acres of land to someone else. This was 9.84% of the total land. As would be expected the urban respondent leased a larger proportion of his land to someone else. The average amount of acreage leased per urban respondent was 62.54 acres or seen in another way 22.82% of the land is leased to someone else.

The average rural respondent that owned or leased five or more acres of land planted 14.45% of the land in maize and 19.41% of the land in cotton, and sold an average of 15.28 head of cattle per year. This compares to the average urban respondents utilization of 10.24% of his land cultivated in maize, 14.21 in cotton, and

an average of 12.67 head of cattle sold per year per respondent. The total amount of land that was owned or leased by the rural respondents of five or more acres was 25,440 with the urban respondents' total being 6579 acres.

2. % of total income derived from farm:

| | Urban | | Rural | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Less than ¼ | 6 | 30.00% | 35 | 33.01% |
| ¼ | 7 | 35.00% | 23 | 21.07% |
| ½ | 5 | 25.00% | 9 | 8.50% |
| 3/4 | 2 | 10.00% | 6 | 5.66% |
| All | 0 | .00% | 33 | 31.13% |
| | 20 | 100.00% | 106 | 100.00% |

Analysis of West, Texas

Only one day was spent in West, Texas because of the poor response of the people to the survey. Most of the people contacted were either too suspicious of the questionnaire to complete it, or felt that the government was wasting money since they felt that everybody in the community was in favor of the proposed reservoir. However from talking to several people informally, including the mayor's wife, it does appear that West, Texas does want the proposed Aquilla Creek Reservoir very much and there appears to be very little opposition, if any. The respondents interviewed felt that the proposed reservoir was very important for the economic growth of West, and a necessity for drinking water in the future.

## PROJECTED CHANGES AFTER IMPOUNDMENT

### Social Trends

There should be no marked social change in the area after impoundment. The only changes that should occur are those changes which normally take place with any increase in population and economic growth. If the community of Whitney is a good example of the effects of a reservoir on a community, then those communities already discussed in this report should increase in population. The extent of this increase cannot be made known at this point. However during the ten-year period from 1960 to 1970 Whitney's population increased 30.6% .

### Ethnic Trends

There are no real ethnic communities in Hill County unless second and third generation Czecks are considered. According to the 1970 census 86.24% of Hill County was white and Hill County had only a 13.05% black population. These two groups compose all but .71% of the population of the county; therefore the effect of the proposed reservoir after impoundment should be no greater on one minority group than another.

### Recreational Projection

Because of the excellent recreational facilities of Lake Whitney, Lake Waco, and Navarro Mills in the region, there is little data at this time that can indicate how much recreation usage will be drawn from these lakes, or how much new recreation potential will be created by the proposed Aquilla Creek Reservoir. The only projected data in response to this question have already been indicated by the Hillsboro respondents.

1. Projected number of visits per year to the proposed Aquilla Creek Reservoir as indicated by the Hillsboro respondents.

| | No. of Respondents | Percentage |
|---|---|---|
| 2-10 | 19 | 52.78% |
| 11-20 | 4 | 11.11% |
| 21-30 | 5 | 13.89% |
| 31-50 | 2 | 5.56% |
| 51+ | 6 | 16.67% |
| | 36 | 100.00% |

## Economic Trends

It has already been reported that the majority of the respondents in the survey feel that the proposed reservoir would benefit the community economically. Two hundred and thirty respondents (7f.50%) said they felt that the reservoir would benefit the community economically. Thirty-seven (12.63%) of the respondents in the survey stated that it would have no economic effect and 8 (2.73%) said that it would have a negative economic effect, while 18 (6.14%) of the respondents answered that they were not sure.

It is felt that the largest economic boost would come to the city of Hillsboro. This fact seems to be based on the substantial labor power both in and around Hill County as reported by the TEC, and the proximity of three large consumer markets (Dallas, Fort Worth, Waco), transportation facilities and access by rail and interstate highway. Other factors are the availability of accredited public schools through the Junior College level, state and local recreation opportunities, as well as public and private health facilities.

According to the TEC report (1971) the manufacturing and services growth in the past decade has significantly helped the economy. Through discussion with city officials it has also been learned that several industries have already expressed interest in locating in Hillsboro if an adequate water supply is established. Many respondents in and around the proposed lake location have reported that they have already been approached by large real estate companies in Dallas and Fort Worth who plan

development of the lake frontage. This would definitely increase the housing units in the rural areas as well as help to provide some business to the smaller communities such as Aquilla and Peoria.

One of the strongest variables of economic growth of any area is the strong desire on the part of its residents to see the area grow. According to the survey this desire is very strong in Hill County. 247 (78.91%) responded that they would like to see their community increase in population as opposed to 64 (20.48%) that said no, and 2 (.61%) stating that they were not sure.

As these factors indicated, there does appear to be potential for both economic and population growth in Hill County.

# CONCLUSION

This report has attempted to present relevant material on all levels in relationship to the proposed Aquilla Creek Reservoir. Socio-economic data have been presented both in general form and in specific form. This procedure has also been utilized in presenting data on recreation and land utilization as well as presenting present attitudes toward the reservoir of various potential factions.

The figures in this report seem to indicate that there is substantial economic potential in the region defined in this report, and that although there is some marked opposition in the directly affected area, it is not as strong as might be expected. Those that oppose the proposed reservoir compose only a small faction, being more verbal than action oriented. It is felt that the majority of the households that will be directly affected do feel that the project will benefit the overall community. Their major concerns seem to be expressed in terms of not being adequately compensated for the losses and the expressed inability to plan for the future.

APPENDIX

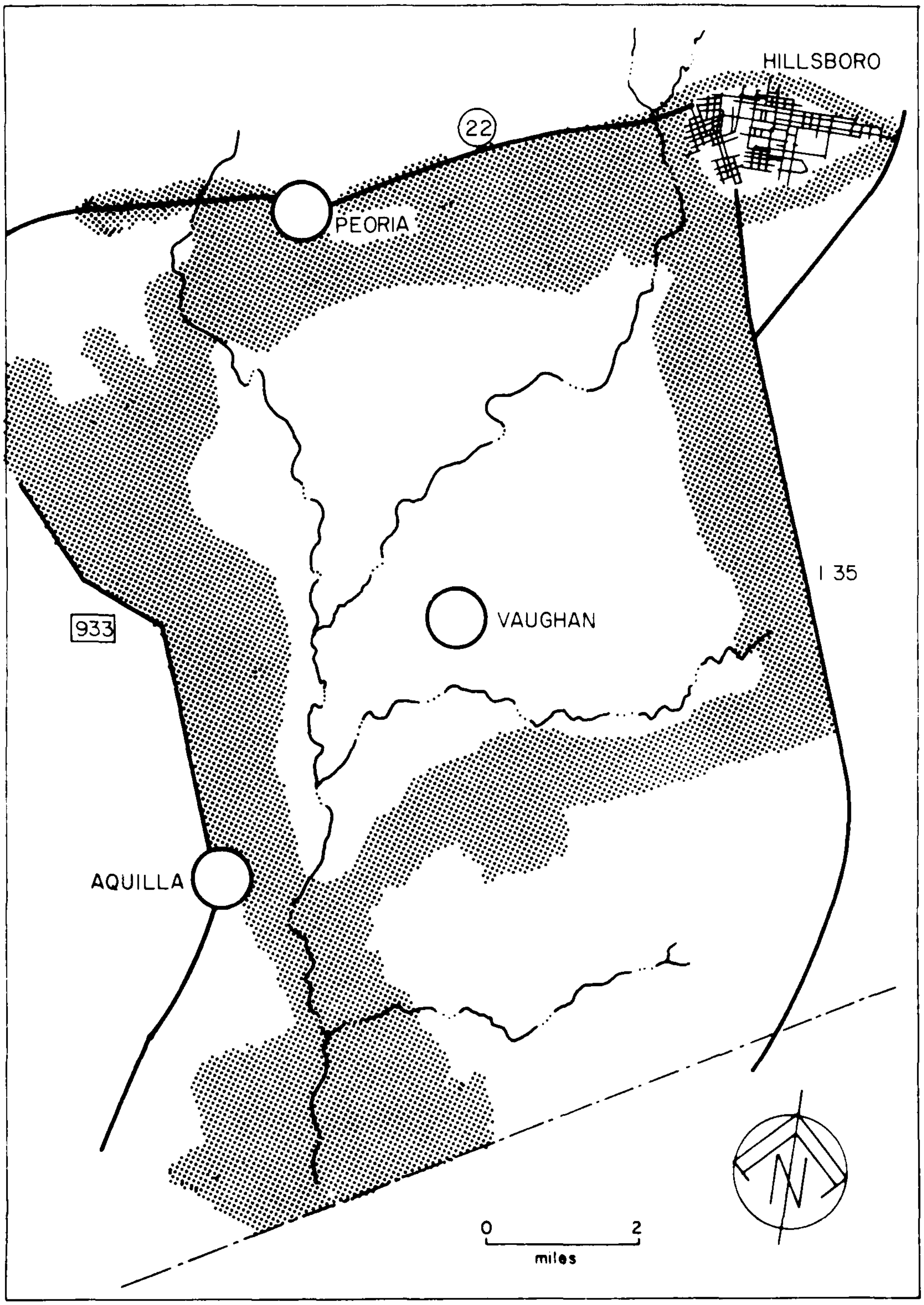


Figure 9. Geographic Area of Cultural Evaluation Study.

SOUTHERN METHODIST UNIVERSITY

DEPARTMENT OF ANTHROPOLOGY
DALLAS, TEXAS 75222

Dear

As you may know, the Corps of Engineers has proposed building a reservoir on Aquilla Creek with the dam placed just north of Aquilla, Texas. When filled the lake will extend up Aquilla Creek to Highway 22.

The Department of Anthropology at Southern Methodist University in Dallas, Texas is conducting a water resource survey of the Aquilla Creek Watershed area. The acceptance or rejection of this proposed reservoir depends in part upon public opinion. It is extremely important that you take part in this voluntary survey so that results are representative of all groups of people within the region.

Please fill in the following questionnaire as soon as possible and return it in the enclosed, stamped, self-addressed envelope. The questionnaire is designed to take about fifteen minutes to complete.

I assure you that the report which you submit will remain completely confidential.

We sincerely thank you for your cooperation in this important matter.

Sincerely,

John W. McCall III
Department of Anthropology
Southern Methodist University

HILL COUNTY WATER RESOURCE SURVEY

DIRECTIONS: Answer as accurately as you can by printing your reply where blanks are provided or by entering an "X" in the small enclosure to the right of the appropriate reply. If you find that there is not enough space to answer a certain question, simply write the question number on the back of this questionnaire and answer accordingly. After completing the questionnaire, any further comments or questions will be greatly appreciated and can be placed on the back.

1. Your name ______________________________.

2. Present address (street or highway) ______________________.
(town or nearest town) ______________________.

3. Today's date: day__________month__________year________.

4. Sex: male ( ) female ( ).

5. Race: Caucasian ( ) Negro ( ) Mexican Amer. ( ) Other ( ).

6. Age in years: under 21 ( ) 21-35 ( ) 35-55 ( ) 55-65 ( ) over 65 ( ).

7. Number of years of schooling completed __________________.

8. Highest school degree held ________________(B.A., M.A., etc).

9. What is your occupation? ______________________________.

10. Are you presently employed in this occupation?
Yes ( ) How long? ____________. No ( ) If no, what is your recent occupation? __________________ How long? ________.

11. How long have you lived in: Texas ___________ Hill Co. _____.

12. Do you own this home? Own ( ) Rent ( ).

13. Did you own or rent your former dwelling? Own ( ) Rent ( ).

14. Why did you move here? ______________________________.

15. If you had to leave here for some reason and live somewhere else, would you miss this place?
Very much ( ) Some ( ) Not at all ( ).

16. Do you ever wish you did not live here?
Often ( ) Sometimes ( ) Seldom ( ) Never ( ).

17. How many other people live with you at this present address? ____.

18. How long did you live at your last previous address? __________.
(give in nearest months or years)

SECTION II

The following section is composed of questions dealing with Water Resource Development and the proposed Aquilla Reservoir.

1. As far as you know, what is the source of your drinking water?
   Lake ( )  River ( )  Well ( ).

2. About how far away from your residence is this source of water located? ______________________.

3. What lake in Texas do you most often visit? ______________.

4. About how many times a year do you visit this lake?__________.

5. Why do you visit this lake? (rank in order of importance 1,2,3, etc.)
   To fish ( )  To ski ( )  To boat ( )  To camp ( )  To picnic ( )
   Other ______________________________.

6. What other lakes in Texas do you frequently visit?
   (give number of times per year for each) ______________.
   ______________. ______________. ______________.

7. Why do you usually visit these other lakes? (rank in order)
   To fish ( )  To ski ( )  To boat ( )  To camp ( )  To picnic ( )
   Other ______________________________.

8. Did you know that a lake on Aquilla Creek was being planned before you received this questionnaire? No ( )  Yes ( ).
   How long have you known? ______________________.

9. How did you first learn about the project?
   Another person ( )  The newspaper ( )  The radio ( )
   Television ( )  Other ______________________.

10. Why do you think they have proposed to put another lake in this region? (check one or more)
    A. To provide more water and camping recreation outlets for this region. ( )
    B. To provide a greater source of drinking and industrial water for this region. ( )
    C. To help bring more business and industries into the area. ( )
    D. Other ______________________.

11. If the Aquilla Reservoir is built, how many times a year do you think you would visit it? ______________________.

12. What would be your main uses of the Aquilla Reservoir?
    To fish ( )  To ski ( )  To boat ( )  To camp ( )  To picnic ( )
    Other ______________________________.

13. Is there any other person at this address whom you feel would use the Aquilla Reservoir more than yourself? No ( ) Yes ( ) If yes, give relationship to you ________________________ and age ______________.

14. Do you own land that would be covered or bordered by the Aquilla Reservoir? (If yes, state quantity to nearest acre)

| WOULD BE COVERED | WOULD BE BORDERED |
|---|---|
| Yes ( ) quantity owned _________. | Yes ( ) quantity owned ______. |
| No ( ) | No ( ) |
| Not sure ( ) | Not sure ( ) |

15. DO YOU APPROVE OR DISAPPROVE of the newly proposed reservoir? (check one under A or B)

A

1. I approve, but it does not make much difference to me ( ).
2. I approve, but would not fight for it in the light of strong opposition ( ).

B

1. I disapprove, but it does not make much difference to me ( ).
2. I disapprove, but would not fight against it in the light of strong opposition ( ).
3. I strongly disapprove, and would fight against it no matter how strong the opposition ( ).

16. IF YOU APPROVE OF THE PROPOSED RESERVOIR what are the reasons?

1. It would increase my and my family's chance for greater water recreation involvement ( ).
2. It would increase the community's chance for greater water recreation involvement ( ).

17. 1. Do you think that the Reservoir would
   (a) benefit you or the community economically.
   (b) have no economic effect on you personally.
   (c) have a negative economic effect.
   (d) other: ____________________________________________.

   2. Can you think of any disadvantages that would be brought about by the creation of the Aquilla Reservoir?
   No ( ) Yes ( ) (If yes, for what reasons) __________________
   ____________________________________________________________.

18. IF YOU DISAPPROVE what are the reasons? (check one or more)

| 1. It would bring in: | It would cause: |
|---|---|
| undesirable people ( ) | me to sell my land ( ). |
| undesirable businesses ( ) | me to move ( ). |
| There are already enough lakes in this region ( ) | a friend or relative to move ( ) |
| Other ________________________ | a friend or relative to sell land ( ). |

2. Can you think of any advantages that would be brought about by the building of the Aquilla Reservoir?
No ( ) Yes ( ) (If yes, give reasons) ______________________
______________________________________________________________.

19. Would you like to see Hillsboro increase in population?
Yes ( ) No ( )

20. How large would you personally like to see it? ____________________
______________________________________________________________.

21. How much can you do to influence political decisions affecting your neighborhood?
I can do a very great deal ( )
I can do quite a bit ( )
I can do something ( )
I can't do much ( )
I can't do anything ( )

22. Would you prefer to see the natural environment of Aquilla Creek remain unchanged? Yes ( ) No ( )

23. Is there anyone else at this address who would express an opposite opinion from the one you hold?
No ( ) Yes ( ) (If yes, give name and relationship to you)
______________________________________________________

*If you own a farm in Hill Co., please fill out Form B on next page.

LAND UTILIZATION ANALYSIS

FORM B

1. Total number of acres of this farm ____________________________.

2. Total number of acres per year put into cash crops ____________.

3. What is the number one cash crop put into cultivation each year? ___________________________ How many acres? ______________.

4. How much livestock is raised for market sell each year?

   Number of cattle ____________.

   Number of hogs ______________.

   Number of chickens __________.

   Other ________________________.

5. How many people are employed on a yearly full time basis? ________.

6. How many people are employed on a half-time basis? _______________.

7. How many weeks or months of the year are they employed? __________.

8. How much of this farm makes up your source of income?
   1/4 ( ) 3/4 ( ) 1/2 ( ) All ( )

9. If this farm is not your total source of income, please give other sources?

   ___________________________________

   ___________________________________

   ___________________________________

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# GEOLOGICAL RECONNAISSANCE OF THE AQUILLA CREEK RESERVOIR BASIN

by

Ronald Ritchie

and

Bob H. Slaughter

## INTRODUCTION

The channels of Aquilla Creek and its major tributaries, Hackberry and Cobb Creeks were prospected for outcrops and fossils, as were the bluffs overlooking the basin. It was discovered that deep soil development and colluvium obscures much of the surface geology. Therefore stratigraphic comparisons were made with basins of similar-sized streams in north central Texas where radiocarbon and paleontological studies have been carried out. As a result, we feel a fairly accurate outline of the history of the basin is possible.

### BEDROCK

Only one good outcrop of bedrock was located: 0.7 miles west of Aquilla Creek immediately south of Farm-to-Market Road 310. At this locality a good exposure of yellow ferruginous sandstone which is typical of the Dexter Member of the Woodbine formation (Cenomanian) outcrops. No fossils were recovered here, but the stratigraphic position and lithology strengthens reference to this member.

Soils almost throughout the basin are of the type derived from Woodbine bedrock. Along the north bank of Cobb Creek there are some Black Gumbo soils often associated with the Eagle Ford formation which overlays the Woodbine. These do not seem to occur within the basin itself and no fossils were found in the floats that could have demonstrated the presence of the Eagle Ford under the colluvium. However, several identifiable fossils of marine forms (e.g. *Macraster* and *Alectrigonia*) were collected from the float of Aquilla Creek adjacent to the mouth of Hackberry Creek and this demonstrates access of the drainage to middle Cretaceous rocks of the Washita Group.

It is uncertain if these rocks actually outcrop within the basin and are currently covered by colluvium, or if these fossils were carried to the uplands adjacent to the drainage prior to its development and then were redeposited. The latter hypothesis would require the specimens to have been exposed for much of the Pleistocene; however, their preservation would seem to negate this possibility. Therefore, we feel that at least a small portion of the headwater bedrock is Washita in age.

## COBBLE FIELDS OF PROBABLE LATE TERTIARY ORIGIN

Metaquartzite and chert cobbles were found on the divides, particularly between Aquilla and Hackberry Creeks and north of Hackberry Creek. There is no source for these river cobbles within the drainage of Aquilla Creek. The cherts could be derived from lower and middle Cretaceous formations that outcrop not far to the west but the closest source for the metaquartzites seems to be the Manzano Mountains of North central New Mexico. Menzer and Slaughter (1971) discussed the discovery of Manzano Mountain metaquartzites in North central Texas and concluded that they were brought here just prior to, or during the earliest Pleistocene, when there was an alluvial ramp extending from the high plains to the Gulf of Mexico and perhaps the Mississippi River. This would infer that all Texas river drainages are post-Pliocene in age. At least we can be certain that these river cobbles are pre-Aquilla Creek.

## QUATERNARY DEPOSITS

The oldest sediments that can be attributed to Aquilla Creek deposition are fairly well exposed in two old gravel pits one mile downstream from the Aquilla-Hackberry Creek junction, on the Chupik farm (Fig. 10). Inferior outcrops of these same deposits are available between Aquilla and Hackberry Creeks and along the north bank of Hackberry Creek. These are old floodplain deposits that now stand fifty feet above the current floodplain and nearly 70 feet above the creek beds. They are made up of locally derived gravels and sands with a few exotic quartzite pebbles that no doubt were redeposited.

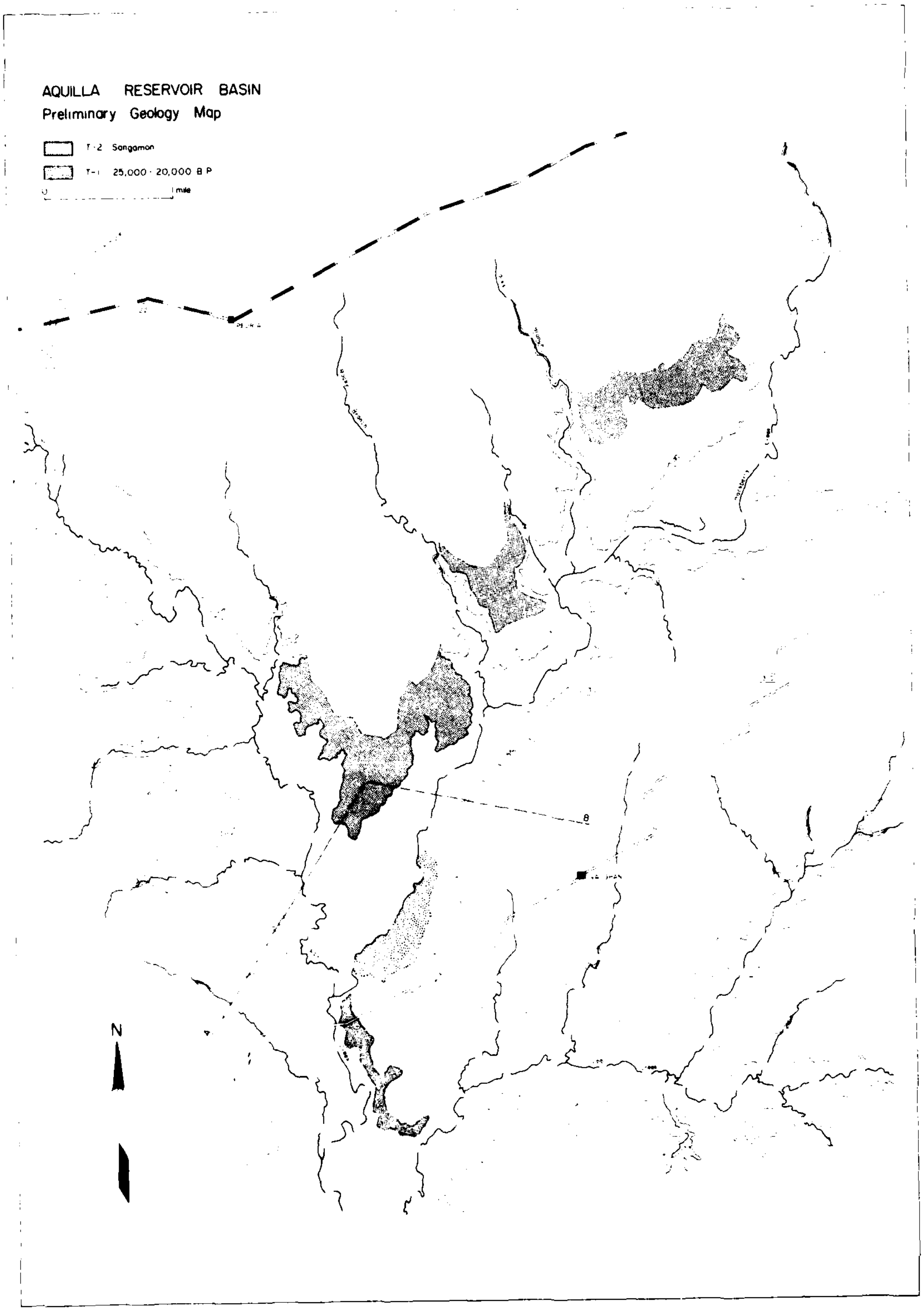


Figure 10. Geologic Map of Aquilla Creek Watershed.

from the late Tertiary cobble fields mentioned above. There can be little doubt that these deposits represent the Sangamon interglacial period (some 100,000 years ago) when many Texas River valleys aggraded. In exposures of sediments of this age on other streams where the sediments are not derived from the rather acid bedrock, vertebrate fossils are quite common, and are typified by remains of mammoth, horse, camel, sloth, and others.

During the early Wisconsin glacial stage Aquilla Creek like other Texas streams was downcutting, and we have no sediments representing the period from the end of the Sangamon and about 25,000 years ago. The current floodplain is apparently underlain by older alluvium we believe to be related to the rise that occurs along the west bank of Hackberry Creek near its mouth. Auger checks seem to indicate that this rise (Fig. 11) is actually the top of an intermediate age valley fill and that the full section of this fill has been partially removed most places in the valley. By analogy to similar rarely preserved terraces on other related streams, this valley fill would have accumulated during an interstadial period of the Wisconsin, circa 25,000-20,000 years ago. Any excavations into or across these deposits would be of considerable interest to paleontologists and archaeologists alike.

The period from 20,000 to about 12,000 years ago was one of renewed downcutting along streams of the Gulf Coastal Plain, but some streams had minor valley filling from 12,000 to about 9,500 years ago. We have found no indication of sediments of this age in the valleys of Aquilla Creek or its tributaries. It may be that they are simply obscured by the recent alluvium, or they may have been removed during the downcutting that was renewed about 8,000 years ago.

Recent sediments bearing occasional bones of *Bison bison* and modern livestock are quite deep near the streams, at least in excess of 15 feet. The presence of gravels below the level of the current stream bed demonstrates considerable aggradation of the valley in Recent times,

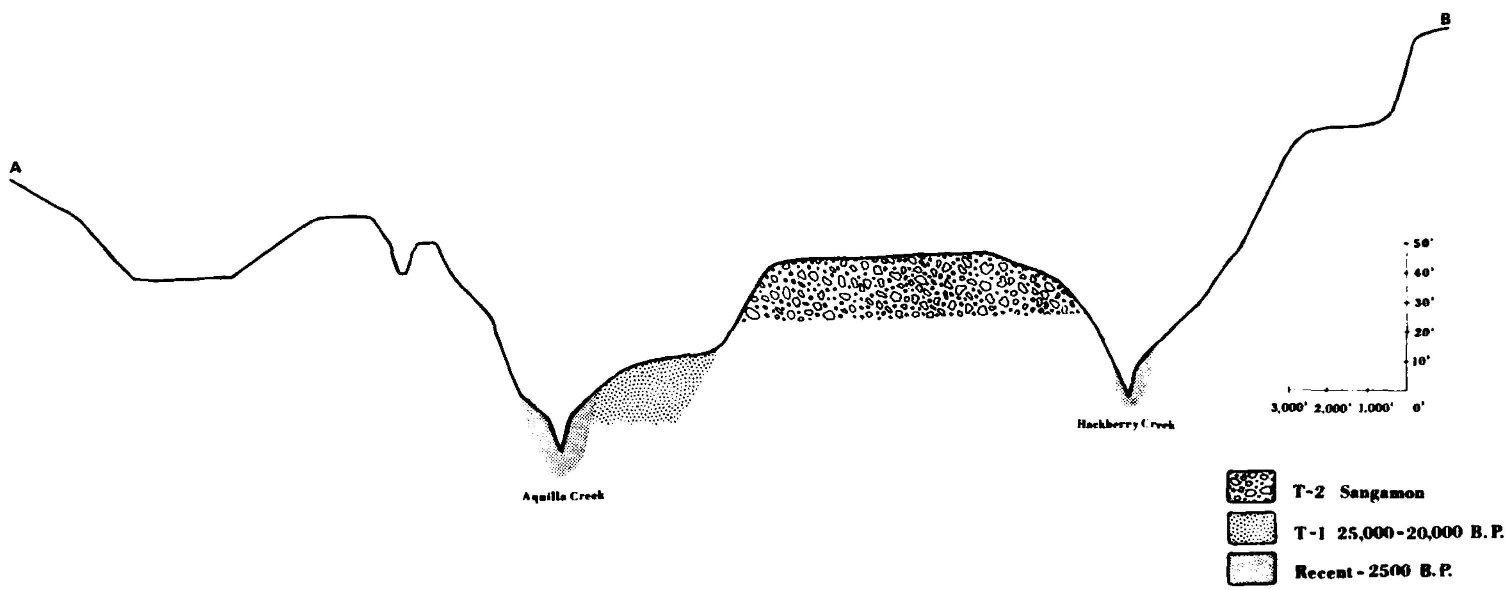


Figure 11. Geologic Profile across Aquilla and Hackberry Creeks.

probably within the last 2,500 years.

## CONCLUSIONS AND SUMMARY

The basin of the proposed reservoir probably straddles the contact between the middle Cretaceous Washita Group and the upper Cretaceous Woodbine formation. If so, the contact must be very near the headwaters of Aquilla Creek itself. Most of the basin is underlain by the Woodbine formation (Cenomanian). Exposures are poor, and fossils are unavailable. Even so, the one good exposure near the dam site "C" represents the Dexter Member.

The presence of middle Cretaceous deposits is indicated by the occurence of marine fossils of that age on the stream's gravel bars.

River cobbles of exotic metaquartzites found on the divides demonstrate that a drainage crossed the area prior to the origin of the Aquilla Creek drainage. Considering the fact that the oldest Aquilla Creek related deposits are Sangamonian while the larger streams of the area usually have Yarmouthian age terraces preserved, it is suggested that the origin of this stream system took place after the middle of the Pleistocene. The stream was as large or perhaps larger with respect to flow size some 100,000 years ago when the valley underwent its first period of aggradation.

After a downcutting of some 30 feet between 100,000 and 25,000 years ago a second period of aggradation occurred. It in turn was partially removed and partially elevated and isolated during the downcutting period of 20,000-12,000 years B.P. No other deposits have been recognized between this point and the beginning of the modern valley filling which we believe to have started about 2,500 years ago. The stream seems to be continuing to aggrade, but this is probably due to the activities of modern farming and other construction.

# RECOMMENDATIONS

The bedrock geology of the Aquilla Creek Watershed is generally well understood although extensive exposures are not present due to the more recent filling of the valleys. These Quaternary sediments have proved to contain the remains of extinct megafauna. In addition, evidence of man associated with these fossils has been found elsewhere and may occur in the reservoir area.

On the basis of these data, we recommend that detailed investigation of the specific deposits from which dam fill is obtained be carried out before any intact fossils or human remains therein contained are permanently disturbed. In addition it is suggested that detailed reconnaissance of areas where extensive land clearing is done be visited by a trained paleontologist after the ground cover has been removed.

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AQUILLA CREEK BOTANICAL SURVEY

By

Jerry M. Flook

Assisted by

Greg H. Hall

Supervised by
William F. Mahler

## Objectives

The primary goals of this botanical study were twofold: (1) To locate rare or endangered species which merit special efforts toward protection and preservation, (2) To characterize as nearly as possible the significance of the plant community in the overall ecology of the area in question.

## Methods of Study

The area of the drainage basin to be occupied by the proposed reservoir was divided into 20 smaller study plots for convenience in pinpointing collection localities (Fig. 12). Collections were then made during the summer (June-September) of 1972 of the vascular plants from representative sites distributed throughout the area under study. The specimens collected were preserved according to standard techniques and were critically identified using the extensive taxonomic resources available through the herbarium of Southern Methodist University. After their identification, the specimens were labelled with pertinent collection data and placed on permanent file in the S.M.U. Herbarium.

Standard quantitative procedures were employed to obtain an indication of relative ecological dominance within the principal plant communities of the study area. A transect line was laid off along Aquilla Creek from its junction with Cobb Creek to a point 1.5 miles upstream (Fig. 13). All arborescents over 1 inch in diameter at breast height (DBH) which were intercepted by that transect line were identified and their DBH and diameter of shade coverage recorded.

## Results and Analysis

Vegetational zonation in Texas has been studied by Bray (1906), Tharp (1926, 1939), Allred and Mitchell (1955), and Kuchler (1964). The Aquilla Creek study area lies mainly within the southern extremity of the Eastern Cross Timbers (as characterized by Tharp, 1926)

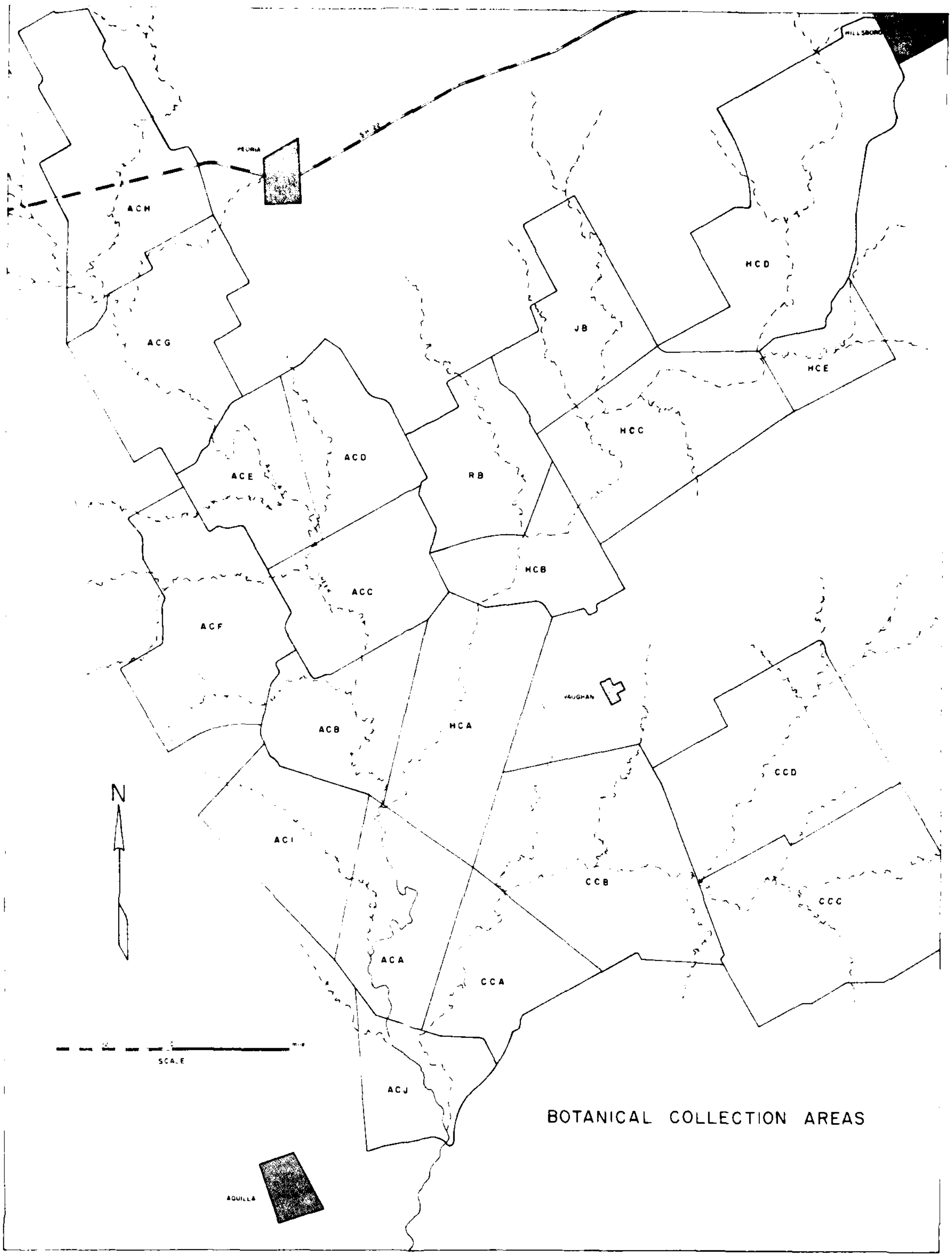


Figure 12. Study Areas within Reservoir Area.

with portions of the upper reaches of the basin extending into the Blackland Prairie on the east. See Fig. 13.

## Eastern Cross Timbers

The belt of post and blackjack oak woodland referred to as the Eastern Cross Timbers follows closely the aquiferous Woodbine Sand formation from the Red River into southern McClennan County. At least two interpretations have been advanced regarding the nature of the true climax community of the Cross Timbers. Tharp (1926) considered the dominants of the climax (i.e., the stable, self-perpetuating, final stage of ecological succession) to be the oaks and hickories. However, according to the interpretation of Weaver and Clements (1938) and of Dyksterhuis (1948), originally in the absence of environmental disturbance the natural dominants of the Cross Timbers were grasses--particularly little bluestem (*Schizachyrium scoparius*), big bluestem (*Andropogon gerardi*) and Indian grass (*Sorghastrum avenaceum*)--with scattered oaks in a savannah-like formation. In such case the present oak woodland represents a disclimactic condition caused by destruction of the original dominants by cultivation and overgrazing.

The characteristic vegetation of the Eastern Cross Timbers, whatever its origins, exists only in a few scattered remnants in Hill County today. Most of the woodland has been completely cleared to make way for pasture and cultivation, particularly in the areas nearer watercourses where the deeper, more moist soils are more desirable for farming. Consequently, most of the few persisting remnants of this vegetational association in Hill County are in upland, dissected areas and should therefore sustain little direct impact from reservoir construction.

Scattered stands of mesquite (*Prosopis*) savannah are located throughout the study area, particularly in the western drainage of Aquilla Creek. This is, however, a weedy species and is also an indicator of ecological disturbance.

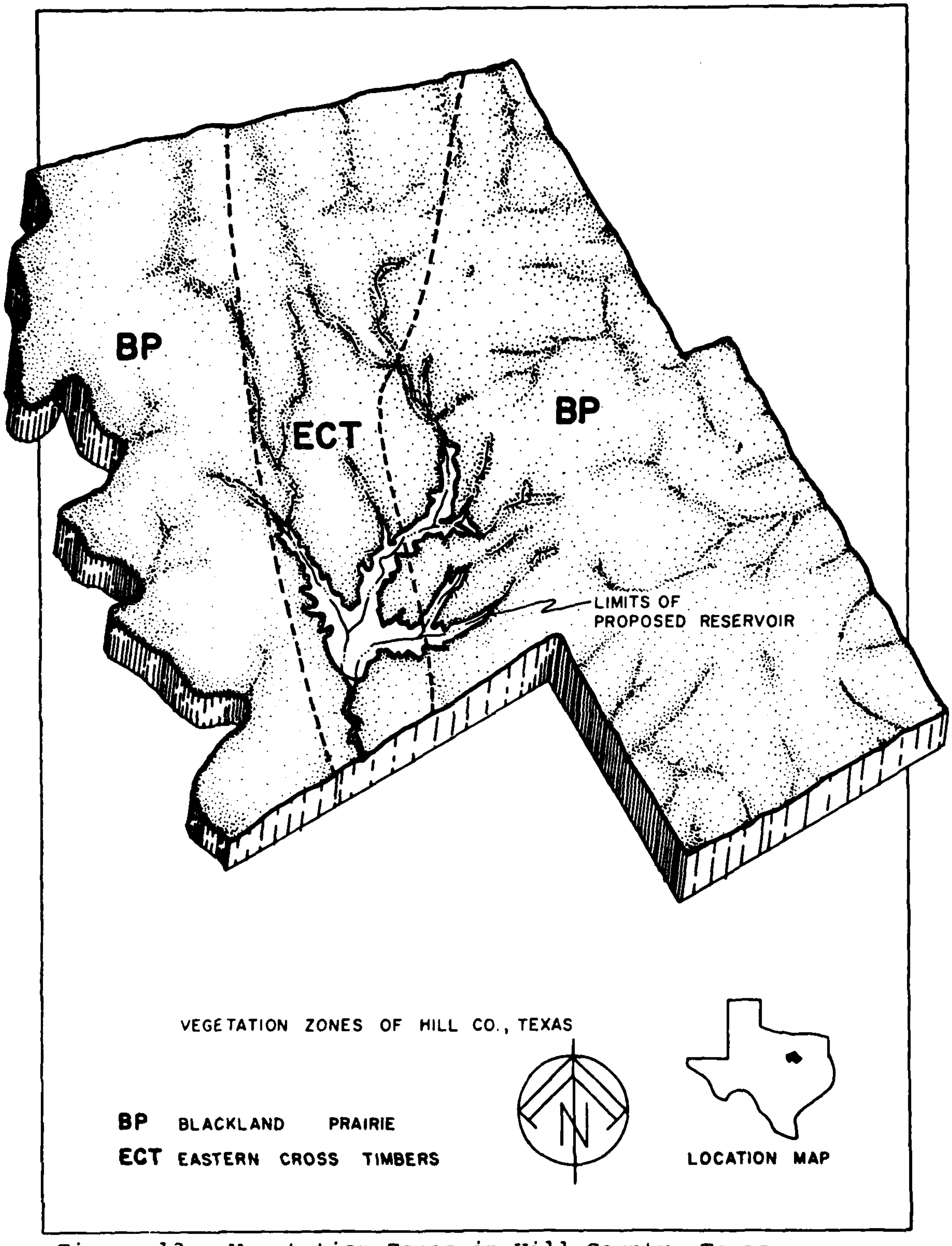


Figure 13. Vegetation Zones in Hill County, Texas.

## BLACKLAND PRAIRIE

The upper reaches of the eastern and northern (Cobb Creek and Hackberry Creek) forks of the proposed reservoir lie within the vegetational association referred to as the Blackland Prairie. This region is typified by alkaline black clay soils with high organic content overlying the parent Cretaceous limestone. The natural climax is grassland with little bluestem (*Schizachyrium scoparius*) as the dominant species (Dyksterhuis, 1964); however, as in the case of the Cross Timbers, most of this community, where still present at all, is in a state of disclimax resulting from cultivation and overgrazing. The disclimactic dominants are speargrass (*Stipa leucotricha*) and silver bluestem (*Bothriochloa saccharoides*).

Because of the desirability of the fertile soils of the Blackland Prairie for cultivation in cotton, sorghum, and other crops, very little of this grassland association has survived in Hill County. What little remains is in heavily grazed pasture and consequently retains few of its natural characteristics.

## BOTTOMLAND FOREST

The bottomland forests of the eastern half of Texas are quite different vegetationally from the prevailing plant association in which they are located. Bray (1906) treated these bottomland associations as a distinct vegetational type, considering them to be extensions of Austroriparian forests of the South and Southeast. These woodlands owe their existence to the abundance of water along the waterways draining lands that would otherwise be too dry to support heavy growth of large trees. The bottomland forest is the best-preserved of the vegetational communities surviving in Hill County (Figs. 14a and b, 15) and therefore was studied in greatest detail in this report (see Fig. 15).

Shade coverage data derived from the previously described transect-intercept sampling along the course of Aquilla Creek indicated that the bottomland forest

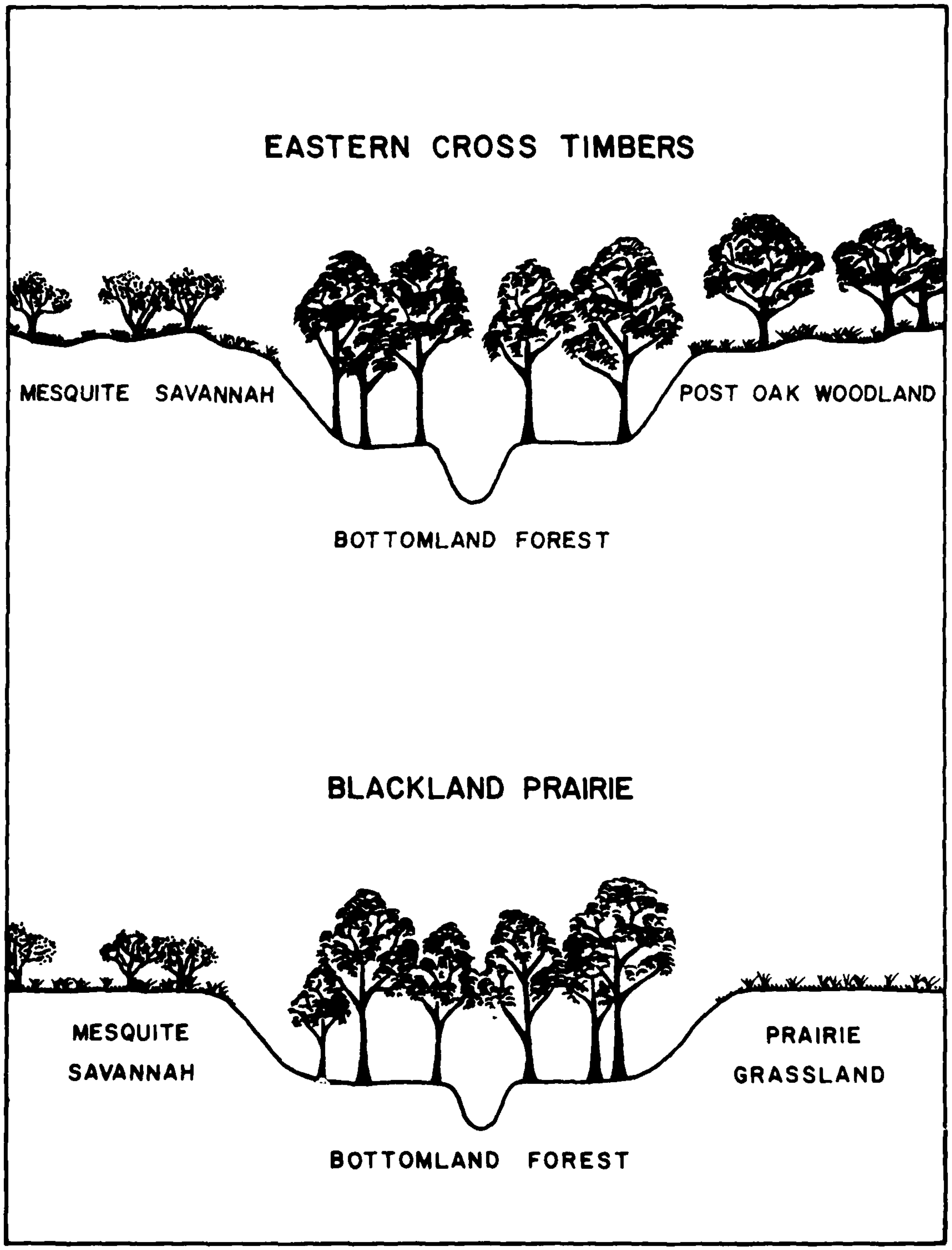


Figure 14. Botanical transect across watershed.

Fig. 15. General aspect of the bottomland forest along Aquilla Creek immediately south of proposed dam site C.

community in the study area is primarily a Red Ash-Cedar Elm-Hackberry association. Scattered large specimens of Red Oak, Slippery Elm, and Pecan were also noted, but not in sufficient numbers to play an important role in community dominance. Results of the transect-intercept sampling including percentage of total shade coverage for each species are presented in Table 1.

Table 25. Transect-Intercept Sampling (Aquilla Creek): Percentage Total Shade Coverage

| | |
|---|---|
| Red ash (_Fraxinus pensylvanica_) | 32.24% |
| Cedar Elm (_Ulmus crassifolia_) | 29.73% |
| Hackberry (_Celtis laevigata_) | 19.75% |
| Red Oak (_Quercus shumardii_) | 3.66% |
| Slippery Elm (_Ulmus rubra_) | 3.12% |
| Pecan (_Carya illinoinensis_) | 2.61% |
| Red Mulberry (_Morus rubra_) | 2.30% |
| Post Oak (_Quercus stellata_) | 1.99% |
| Mesquite (_Prosopis glandulosa_) | 1.25% |
| Live Oak (_Quercus virginiana_) | 1.25% |
| Soapberry (_Sapindus saponaria_) | 0.84% |
| Ironwood (_Bumelia lanuginosa_) | 0.63% |
| Deciduous Holly (_Ilex decidua_) | 0.52% |
| Honey Locust (_Gleditsia triacanthos_) | 0.31% |

The understory of the bottomland woods of the study area is rather sparse. In addition to the arborescent species listed in Table 1, the limited understory consists of woody vines such as Fox and Mustang grapes, Poison Ivy, and Green-brier and of frutescents including Rough-leaf Dogwood, Downy and Green haws, Big-tree and Hog plums, Eve's Necklace, Black Haw, and Coralberry.

None of the dominant species of the bottomland forest of Hill County has any significant commercial value. Possible exceptions might be Pecan and the oaks, but they occur in such small numbers as to be of no import in this area.

## Endemic Species

An endemic species is one which is native to a relatively limited geographic area. Endemics are either relicts which at one time had a much wider distribution or young species which are slowly expanding their ranges. Unfortunately little analysis of endemism in Texas species has been done, although lists of rare and endangered endemics has been compiled by the Rare Plant Study Center of the University of Texas and by the USDA Soil Conservation Service. Distribution of endemic plants in the eastern half of Texas has also been plotted by Mahler (1972) in a report to the Corps of Engineers on the environmental resources of the Trinity River Basin.

Table 21 lists species endemic to Texas which have been reported from Hill County either in the botanical literature or in the S.M.U. Herbarium collection.

Table 21. Endemic vascular species previously reported from Hill County, Texas.

| | |
|---|---|
| Aster eulae | Lesquerella recurvata |
| Astragalus reflexus (rare) | *Lupinus texensis |
| *Cirsium terrae-nigrae | *Marshallia caespitosa |
| *Crataegus brazoria | *Silphium albiflorum |
| *Crataegus glabriuscula | Yucca pallida |
| *Indigofera miniata | |

*Those species with flowering and fruiting seasons coinciding with the period during which collections were made in this study.

Although not specifically reported from Hill County, the endemic species in Table 22 have been shown to have distribution patterns suggesting that they might be found in the study area.

Table 22. Endemic vascular species to be expected from Hill County, Texas.

| | |
|---|---|
| Astragalus leptocarpus | *Phlox drummondii var. mcallisteri |
| *Dalea hallei | *Plantago helleri |
| Erigeron geiseri | *Polytaenia texana |

| | |
|---|---|
| Evax candida | *Psoralea digitata |
| *Forestiera pubescens | Psoralea hypogaea |
| *Fraxinus texensis | *Pyrropappus geiseri |
| *Juncus texanus | *Quercus texana |
| *Krigia gracilis | *Rhododon ciliatus |
| *Lechea san-sabeana | *Rosa ignota (extremely rare) |
| Lesquerella engelmannii | *Tradescantia subacaulis |
| *Petalostemum tenue | *Tridens congestus |

*Those species with flowering and fruiting seasons coinciding with period during which collection were made in this study.

The collections made of the vascular plants of the Aquilla study area confirmed the presence of the following endemics from the lists above:

| | |
|---|---|
| Cirsium terrae-nigrae | Lupinus texensis |
| Crataegus glabriuscula | Polytaenia texana |
| Forestiera pubescens | Pyrropappus geiseri |

Although these species are limited in their distribution to the state of Texas, none is considered to be rare or endangered at this time.

The complete list of vascular species collected from the Aquilla Creek Watershed in this study is presented in Table 4. It must be kept in mind that while this inventory includes most of the woody species to be found in the study area, it shows only those herbaceous species which are part of the summer aspect. Because of the time limitations involved in this particular study, no collection data could be obtained for the spring or fall flora of the area. It will be noted from Tables 21 and 22 that 9 of the 33 endemics to be expected in the Aquilla Creek study area are not part of the summer aspect and could be detected only by extension of the collections to include the spring and fall flora. It should also be remembered that populations of many species are so small, the individuals so sparsely distributed, or the generation time so brief that their presence is not likely to be detected by any but the most intense program of collection. Such an effort was beyond the scope of the present

study. Therefore the listing of species presented in Table 23 should not be misconstrued as reflecting the complete flora of the Aquilla Creek study area, but rather as a limited indication of only one seasonal aspect.

Recommendations

Because the natural state of the vegetation of the Aquilla Creek Watershed has already been severly disrupted by agricultural activities, there is little that might from the standpoint of plant ecology oppose the inundation of this area by the proposed reservoir.

However, it is strongly recommended that the botanical inventory for rare and endangered species be extended to include the spring and fall flora of the Aquilla Creek Watershed. All possibility of the presence of any of these species should be eliminated before proceeding with reservoir construction.

It is also recommended that in the event of reservoir construction, every effort be made to preserve the woodland vegetation remaining between the flood and conservation levels of the lake. In order to maintain as much natural plant and animal habitats as possible, extensive areas should be left completely undisturbed with existing undergrowth and ground cover vegetation intact.

Table 23. Inventory of vascular plant species of the Aquilla Creek Watershed (summer aspect only).

| Scientific Name | Common Name |
|---|---|
| _Acer negundo_ L. | Boxelder |
| _Ambrosia artemisiifolia_ L. | Short Ragweed |
| _Ambrosia trifida_ L. | Giant Ragweed |
| _Amorpha fruticosa_ L. | Bastard Indigo |
| _Argemone polyanthemos_ (Fedde) G. Ownbey | Prickly Poppy |
| _Aristida wrightii_ Nash | Wright's Three-awn |
| _Asclepias viridiflora_ Raf. | Green-flowered Milkweed |
| _Aster subulatus_ Michx. var. _ligulatus_ Shinners | Annual Aster |
| _Aster texanus_ Burgess | Texas Aster |
| _Avena sativa_ L. | Oats |
| _Bothriochloa saccharoides_ (Sw.) Rydb. var. _longi-paniculata_ (Gould) Gould | Silver Bluestem |
| _Bothriochloa saccharoides_ (Sw.) Rydb. var. _torreyana_ (Steud.) Gould | Silver Bluestem |
| _Bromus japonicus_ L. | Japanese Chess |
| _Bromus racemosus_ L. | Field Chess |
| _Buchloe dactyloides_ (Nutt.) Engelm. | Buffalo Grass |
| _Bumelia lanuginosa_ (Michx.) Pers. var. _oblongifolia_ (Nutt.) Clark | Ironwood |
| _Carya illinoinensis_ (Wang.) K. Koch | Pecan |
| _Cassia fasciculata_ Michx. var. _fasciculata_ | Partridge-pea |
| _Castilleja indivisa_ Engelm. | Texas Paintbrush |
| _Celtis laevigata_ Willd. var. _laevigata_ | Texas Sugarberry (Hackberry) |
| _Chaerophyllum tainturieri_ Hook. var. _tainturieri_ | Chervil |
| _Chasmanthium latifolium_ (Michx.) Yates | Inland Sea Oats |
| _Cirsium terraenigrae_ Shinners | Blackland Thistle |

| | |
|---|---|
| Cirsium texanum Buckl. | Texas Thistle |
| Cissus incisa (Nutt.) Des Moul. | Cow-itch |
| Cocculus carolinus (L.) DC. | Snailseed (Coralbead) |
| Commelina erecta L. var. angustifolia (Michx.) Fern. | Narrow-leaf Day-flower |
| Commelina erecta L. var. erecta | Erect Day-flower |
| Convolvulus equitans Benth. | Bindweed |
| Conyza canadensis (L.) Cronq. var. glabrata (Engelm. & Gray) Cronq. | Horse-weed |
| Cornus drummondii C.A. Mey. | Rough-leaf Dogwood |
| Crataegus mollis Scheele | Downy Hawthorn (Red Haw) |
| Crataegus viridis L. (incl. C. glabriuscula) | Green Hawthorn |
| Cuscuta cuspidata Engelm. | Dodder |
| Cynodon dactylon (L.) Pers. | Bermuda Grass |
| Daucus pusillus Michx. | Rattlesnake-weed |
| Desmanthus illinoensis (Michx.) MacM. | Shame-weed |
| Dicliptera brachiata (Pursh.) Spreng. | -- |
| Dracopis amplexicaulis (Vahl) Cass. | Yellow Cone-flower |
| Elymus canadensis L. | Canada Wild-rye |
| Elymus virginicus L. | Virginia Wild-rye |
| Engelmannia pinnatifida Nutt. | Engelmann's Daisy |
| Erigeron annuus (L.) Pers. | Daisy Fleabane |
| Eryngium leavenworthii T. & G. | Purple Eryngo |
| Euphorbia dentata Michx. | Toothed Poinsettia |
| Forestiera pubescens Nutt. | Elbow-bush (Spring Herald) |
| Fraxinus pensylvanica Marsh. | Red Ash |
| Gaillardia pulchella Foug. | Indian Blanket (Fire-wheel) |
| Gaura brachycarpa Small | -- |
| Geranium carolinianum L. | Carolina Cranesbill |
| Geum canadense Jacq. | White Avens |
| Gleditsia triacanthos L. | Honey Locust |
| Grindelia squarrosa (Pursh) Dun. | Gumweed (Tarweed) |
| Helenium amarum (Raf.) Rock | Bitterweed |
| Helenium microcephalum DC. | Sneezeweed |
| Helianthus annuus L. | Common Sunflower |
| Hordeum pusillum Nutt. | Little Barley |
| Hymenopappus scabiosaeus L'Her. var. corymbosus (T. & G.) B. L. Turner | Old Plainsman |

| | |
|---|---|
| Ilex decidua Walt. | Deciduous Holly (Possum Haw) |
| Ipomoea trichocarpa Ell. var. torreyana (Gray) Shinners | Purple Morning-glory |
| Ipomoea trichocarpa Ell. var. trichocarpa | Purple Morning-glory |
| Ipomopsis rubra (L.) Wherry | Standing Cypress (Texas Plume) |
| Juncus torreyi Cov. | Torrey's Rush |
| Juniperus virginiana L. | Virginia Juniper (Red Cedar) |
| Kallstroemia parviflora Nort. | -- |
| Krameria lanceolata Torr. | Ratany |
| Lactuca canadensis Jacq. | Wild Lettuce |
| Lactuca serriola L. | Prickly Lettuce |
| Lepidium austrinum Small | Southern Peppergrass |
| Lepidium virginicum L. var. medium (Greene) C.L. Hitchc. | Virginia Peppergrass |
| Lindheimera texana Gray & Engelm. | Texas Yellow Star Daisy |
| Lolium perenne L. | Ryegrass |
| Lupinus texensis Hook. | Texas Bluebonnet |
| Maclura pomifera (Raf.) Schneid | Bois D'Arc (Horse-apple) |
| Matelea gonocarpa (Walt.) Shinners | Milk-vine |
| Medicago lupulina L. | Black Medick |
| Melia azedarach L. | Chinaberry |
| Melilotus albus Lam. | White Sweet Clover |
| Melothria pendula L. | Melonette |
| Monarda citriodora Cerv. | Lemon Horsemint (Beebalm) |
| Morus rubra L. | Red Mulberry |
| Neptunia lutea (Leavenw.) Benth. | Yellow-puff |
| Oenothera speciosa Nutt. | Showy Primrose |
| Opuntia leptocaulis DC. | Desert Christmas Cactus |
| Oxalis dillenii Jacq. | Yellow Wood-sorrel (Sheep Sours) |
| Panicum fasciculatum Swartz var. reticulatum (Torr.) Beal | Browntop Panic Grass |
| Panicum obtusum H.B.K. | Vine-mesquite |
| Parietaria pennsylvanica Muhl. | Hammerwort (Pellitory) |
| Passiflora incarnata L. | Passion-flower (Maypop) |
| Phoradendron tomentosum (DC.) Gray subsp. tomentosum | Mistletoe |
| Phyla incisa Small | Texas Frog-fruit |
| Plantago aristata Michx. | Buckthorn Plantain |
| Plantago rhodosperma Dcne. | Red-seeded Plantain |

| | |
|---|---|
| *Polytaenia nuttallii* DC. | Prairie Parsley |
| *Polytaenia texana* (Coult. & Rose) Math. & Const. | Texas Prairie Parsley |
| *Populus deltoides* L. | Cottonwood |
| *Prosopis glandulosa* Torr. var. *glandulosa* | Mesquite |
| *Prunus mexicana* Wats. | Big-tree Plum |
| *Prunus persica* (L.) Batsch. | Peach |
| *Prunus rivularis* Scheele | Hog Plum (Creek Plum) |
| *Pyrropappus carolinianus* (Walt.) DC. | False Dandelion |
| *Pyrropappus multicaulis* DC. (incl. *P. geiseri*) | False Dandelion |
| *Quercus shumardii* Buckl. | Shumard's Red Oak |
| *Quercus stellata* Wang. | Post Oak |
| *Quercus virginiana* Mill. | Live Oak |
| *Rapistrum rugosum* (L.) Allioni | -- |
| *Rhus glabra* L. | Smooth Sumac |
| *Rhus toxicodendron* L. var. *vulgaris* Michx. | Poison Ivy |
| *Rivina humilis* L. | Pigeonberry |
| *Rubus trivialis* Michx. | Dewberry |
| *Rudbeckia hirta* L. var. *pulcherrima* Farw. | Black-eyed Susan |
| *Ruellia nudiflora* (Gray) Urban | Wild Petunia |
| *Rumex crispus* L. | Curly Dock |
| *Salix nigra* Marsh. var. *nigra* | Black Willow |
| *Sambucus canadensis* L. | Elderberry |
| *Sapindus saponaria* L. var. *drummondii* (H. & A.) L. Benson | Soapberry |
| *Sesbania vesicaria* (Jacq.) Ell. | Bag-pod |
| *Setaria viridis* (L.) Beauv. | Bristlegrass (Foxtail) |
| *Sisyrinchium pruinosum* Bickn. | Blue-eyed Grass |
| *Smilax bona-nox* L. | Stretch-berry (Cat-brier) |
| *Smilax hispida* Muhl. | China-root (Bristly Brier) |
| *Solanum dimidiatum* Raf. | Western Horse-nettle |
| *Solanum elaeagnifolium* Cav. | Silver-leaf Nightshade |
| *Solanum rostratum* Dun. | Buffalo-bur Nettle |
| *Solidago altissima* L. | Goldenrod |
| *Solidago gigantea* Ait. | Giant Goldenrod |
| *Sonchus asper* (L.) Hill | Sow Thistle |
| *Sophora affinis* T. & G. | Eve's Necklace |

| | |
|---|---|
| _Sorghum halapense_ (L.) Pers. | Johnson Grass |
| _Stipa leucotricha_ Trin. & Rupr. | Texas Speargrass |
| _Symphoricarpos orbiculatus_ Moench. | Coral-berry (Buck-bush) |
| _Torilis arvensis_ (Huds.) Link | Hedge-parsley |
| _Triodanis perfoliata_ (L.) Nieuw. | Venus' Looking-glass |
| _Ulmus crassifolia_ Nutt. | Cedar Elm |
| _Ulmus rubra_ Muhl. | Slippery Elm (Red Elm) |
| _Verbena bipinnatifida_ Nutt. | Prairie Verbena |
| _Verbena halei_ Small | Texas Vervain |
| _Vernonia baldwinii_ Torr. | Western Ironweed |
| _Viburnum rufidulum_ Raf. | Black Haw |
| _Vicia dasycarpa_ Ten. | Winter (Wooly-pod) Vetch |
| _Vitex agnus-castus_ L. | Chaste-tree |
| _Vitis mustangensis_ Buckl. | Mustang Grape |
| _Vitis vulpina_ L. | Fox Grape |
| _Xanthisma texanum_ DC. var. _drummondii_ (T. & G.) Gray | Sleepy Daisy |
| _Xanthium strumarium_ L. | Cocklebur |
| _Xanthocephalum texanum_ (DC.) Shinners | Texas Broomweed |
| _Zanthoxylem clava-herculis_ L. | Prickly Ash (Tickle-tongue) |

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ZOOLOGICAL RESOURCES OF THE

AQUILLA CREEK WATERSHED

by

John E. Ubelaker

and

N. Max Hall

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## INTRODUCTION

This report represents a section of an environmental impact study addressed to the effects of a proposed flood-control plan encompassing several streams in Hill County, Texas, upon the present fauna in this region. This research is bipartite and includes sections on aquatic ecology and terrestrial ecology.

In order to achieve a definitive assessment of the impact to fauna caused by changing three streams into a lake in Hill County, Texas, annual data should be obtained for several years in order to establish a reliable base-line for determining species-diversity, population changes, food web relationships, productivity and energy efficiency ratios. The present study permitted a three month research period from June 1 through August. In the interest of accuracy it must be made clear that the findings presented here are of an extreme generalized nature. Any conclusions drawn can only be compared in a most general way to other reports. Observations on the species themselves are limited to common forms and only those present in the three month period of sampling.

## MATERIAL AND METHODS

Collections were taken periodically from 6 sites throughout the region under survey. The sites are described below. Most collections were completed between 9:00 A.M. and 4:00 P.M. Several overnight trips were carried out in order to obtain samples of the nocturnal fauna, particularly insects and mammals.

Site Description:

Collection sites were chosen at several points along the three streams (Figure 16 ).

Site 1. Hackberry Creek at intersection with Bridge 564. This site is located below the sewage disposal plant for the city of Hillsboro, Texas. The stream bed is narrow and the stream is slow moving. The banks adjacent to the streams (4-10 yards) are covered with dense grass and giant ragweed (_Ambrosia_

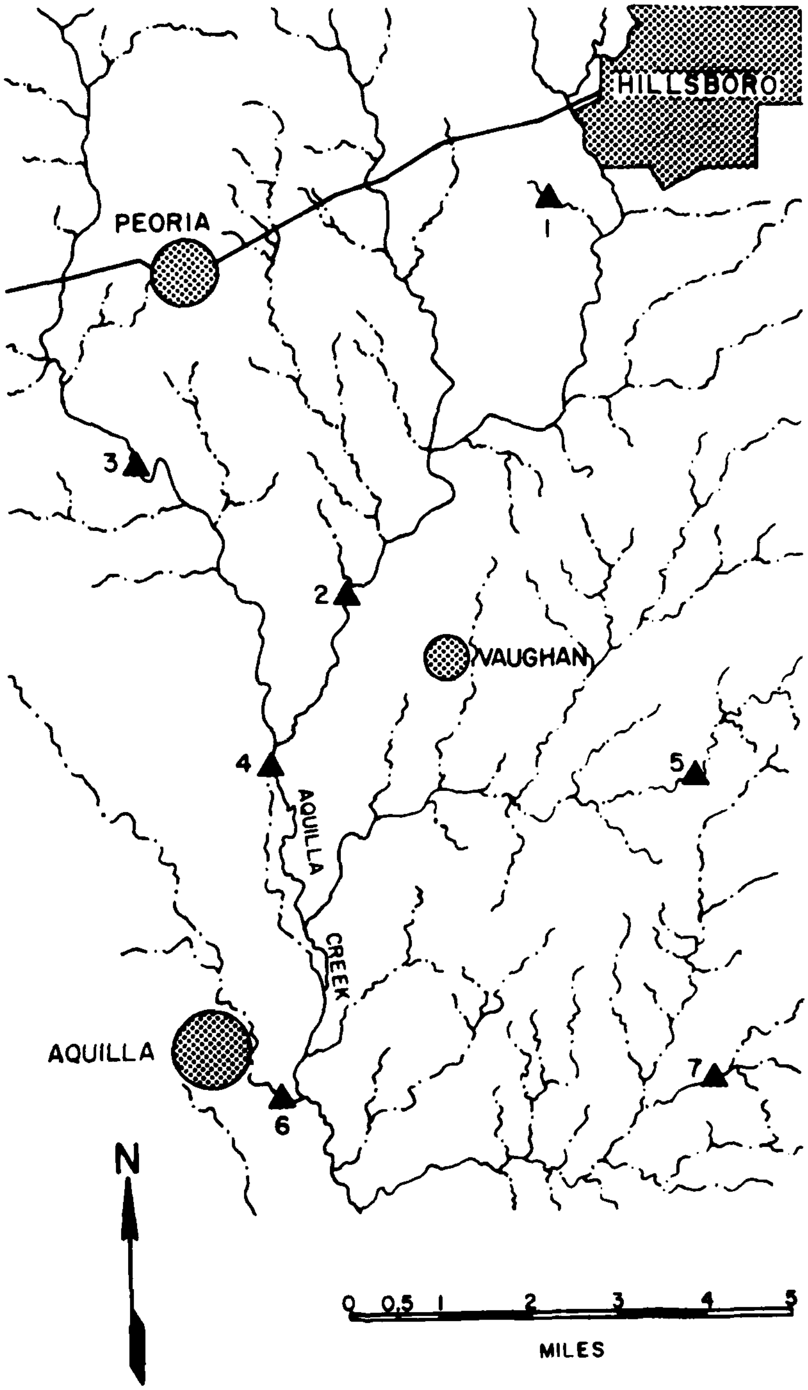


Figure 16. Zoologic Collection Locales.

*trifida*) extending along the bank.

Site 2. Hackberry Creek at Bridge 522 below the confluence of Jacks Branch and Rocky Branch. This site was selected for it lies nearly 3 miles downstream from Site 1. The creek consists of ripples and small pools. The substrata is principally of sand or gravel. Some pools have regions of silt deposits and most of the banks are mud. The bank is grazed by cattle although by late summer a dense growth of giant ragweed was present. The creek is lined on both sides by trees.

Site 3. Aquilla Creek one mile west of Site 2. Cultivated land is divided by Aquilla Creek. Creek bed is of gravel and banks are lined by numerous trees. Giant ragweed is not obvious. Logs in stream retard current.

Site 4. Aquilla Creek after confluence with Hackberry Creek at Bridge 512 on Farm Road 310. Stream is wider, slow moving and silt is apparent. Banks are lined with dense growths of giant ragweed. Pools 4-6 feet deep with mud bottom, ripple area with gravel bottoms, trees numerous along bank.

Site 5. Cobb Creek at Bridge 519. Stream not flowing. Water in pool, stagnant. Water used by cattle.

Site 6. Aquilla Creek after confluence with Cobb Creek at gauging station southeast of Aquilla. Water flowing with pools, banks of creek with dense growth of giant ragweed and trees.

Site 7. Alligator Creek approximately 1 mile south of Site 6. Gravel bed, stream flowing, pools numerous. Bank covered by dense stand of trees.

In addition to these sites, sampling was carried out in the vicinity of Aquilla Creek south of Site 4 to its confluence with Cobb Creek.

In addition to the sites listed above and included on Figure 16 other areas were investigated. These

areas include the vicinity above and below the projected dam site "C" to beyond the junction of Hackberry Creek and Aquilla Creek; several locations on upper Aquilla north of Highway 22 and below the junction of Alligator Creek with Aquilla. In the examination of data, little differences could be observed from the primary collection sites and those secondary areas. In the presentation of data only seven sites are presented. However, they represent the major conditions of each area. Water analysis was not performed on Hackberry Creek above Hillsboro or on Cobb Creek other than the site described above. The former creek lacked water during sampling attempts. Cobb Creek consisted only of stagnant pools with no flowing water.

Sampling Techniques:

300 plankton were obtained by collections in number 25 plankton nets and preserved in 70% ethanol and glycerin. Benthic samples were taken by washing samples through sieve buckets. Macro organisms were hand picked from the fine mesh screens and preserved in 70% ethanol and glycerin.

Temperature, pH and dissolved oxygen were measured immediately after sampling with portable field meters, a Delta 65 Dissolved Oxygen Meter, a Hach Battery-Powered pH Meter and a multi-channel Yellow Spring Teletherm Thermister. Relative transparency was determined with a standard 25 cm Secchi disc. All other chemical analyses were completed within a few hours of sampling. Conductivity was measured with a Hach Conductivity Meter. Colorimetric determinations were made for color, iron (Phenanthroline Method), manganese (Cold Periodate Oxidation Method), nitrates (Cadmium Reduction Method), nitrites (Diazotization Method), phosphates (Ascorbic Acid Method), sulfates (Turbidimetric Method), ammonium (Nessler's Reagent Method) and turbidity. Alkalinity was determined titrametrically by Brom Cresol Green Methyl Red Indicator Method. Total Hardness was determined by titration with sodium hydroxide. These are modifications of standard methods (American Public Health Association, 1971; Golterman, 1972) employed by Hach (1966a).

All identifications were made with the use of an Olympus EH light microscope or AO inverted light microscope.

Entire zooplankton samples were examined in one milliliter Sedgwick-Rafter Counting Chambers. When necessary, individual specimens were mounted and cleared with lactophenol to facilitate identification. All identifications were made under 600X magnification using standard works (Pennak, 1953; Ward and Whipple, 1959).

After preliminary sorting in the field and laboratory, entire samples of macrobenthic forms were identified and counted using a dissecting scope and the Olympus EH light microscope. Annelids and insect parts were mounted when necessary and cleared with lactophenol for identification. Standard works (Pennak, 1953; Ward and Whipple, 1959) were used in the identification of all forms.

Water samples were taken at each site and brought to Dallas for analysis. During transit the samples were chilled and kept in the dark. The elements calcium, magnesium, iron, sodium, potassium and lead were determined by atomic absorption spectroscopy. These tests were performed by Mr. Morris Key and associates Dallas, Texas.

Diurnal samples of terrestrial invertebrates were obtained by inspection of various habitats. Soil samples were run in Berlese funnels under intense light. Insects were collected by sweep nets or collected in various traps. Nocturnal collections were obtained on illuminated sheets. All invertebrates were preserved in alcohol.

Collections of coliform bacteria and fecal streptococcus were obtained from Sites 1, 2, 3, 5, 6 and 7. Samples were obtained by transferring 1/2 liter of water from each site to a sterile container. The container was then chilled and kept in the dark until analyzed. Samples were analyzed by a commercial company, Bio-Assay Laboratory.

In the present survey the more important references dealing with the distribution of vertebrates and invertebrates are included. References were obtained by searching pertinent journals for articles recording animals from Hill County, Texas. In addition to journals, additional information was obtained from Masters and Ph.D. theses at universities in Texas, as well as from technical reports, books and various pamphlets.

Numerous problems are encountered in surveys of this type. There appears to be no single survey of animals in this county. There is less information available about this county than probably any other county in Texas. In the course of this investigation many specimens which the authors were unable to identify were sent to colleagues in other institutions. The majority of these specimens have not been identified at the writing of this report.

The present study area consists of Aquilla Creek, Alligator Creek, Hackberry Creek and Cobb Creek. These creeks comprise part of the large Brazos River basin.

BACKGROUND INFORMATION

The basin includes 45,000 square miles, of which 2,000 square miles are in New Mexico. In Texas, the basin lies south of the Red River basin in the northwest dipping southeast between the Trinity and Colorado River basins to the Gulf. Waters from the upper reaches of the basin (about 9,000 square miles) normally do not enter the main Brazos River, but drain to the playa lakes of the High Plains, or to aquifiers. The basin is 600 miles long and from one to 120 miles wide (Rawson, 1967). The headwaters are near Dimmitt, the White River, and from springs in northeast Bailey County, the Double Mountain Fork, both in the High Plains. The main river begins at the confluence of the Double Mountain and Salt Forks in Stonewall County (Rawson, 1967). The major tributaries are the Clear Fork of the Brazos, rising in Young County, the Paluxy, Little, Navasota, Bosque and Little Brazos Rivers. Lakes Whitney, Possum Kingdom, Buffalo Springs, Waco, Belton, Proctor, and Granbury are the major reservoirs in the basin.

Physiographic regions included in the Brazos River basin are the High Plains section of the Great Plains Province, the Central Lowlands section of the Great Plains Province, and the West Gulf Coastal Plain section of the Coastal Plain Province. Elevation near the headwaters is 4,400 feet above sea level, the climate is semi-arid and rainfall averages 18 inches per year. The climate at the mouth is humid with 49 inches of rain annually (Rawson, 1967). Rawson, in his 1967 Texas Water Development Board report, described the geology and related water quality of the area. The High Plains lie in the Ogallala Formation of Tertiary Age (clay, silt, sand, gravel, caliche) with irregular calcium carbonate cementation. Waters draining this area seldom enter the Brazos system. The Double Mountain and Salt Forks rise in areas underlain successively by rocks of the Dockum Group (clay, shale, sandstone, conglomerate, gypsum, anhydrite) of Late Triassic Age, and Permian Age (shale, anhydrite, gypsum, limestone, dolomite, sandstone). Waters in these formations usually contain more than 5,000 ppm dissolved solids, usually sodium chloride. There are many intermittent

streams in this area composed of saline water seepage from outcrop areas. Water in Double Mountain Fork near Aspermont is hard, highly mineralized, and contains high amounts of sodium chloride, calcium, magnesium and sulfate. The water in Salt Croton Creek is nearly a saturated brine, and Mustang Creek waters near Knox City are hard, calcium sulfate type waters. The Brazos at Seymour varied with flow from the Double Mountain and Salt Forks, when flow was low waters were saline. Permian rocks and Pennsylvanian rocks (shale, sandstone, conglomerate, limestone, coal) underlie the section of river between Seymour and Possum Kingdom Lake and waters here are less highly mineralized, with less than 200 ppm total dissolved solids.

Flow between Possum Kingdom and Lake Whitney is controlled by released water from Possum Kingdom and geologic influence on the water quality is diminished. The areas northwest of Lake Whitney are underlain by the Trinity Group of early Cretaceous Age (limestone, sand, shale, anhydrite, clay, conglomerate) and waters are hard; dissolved solids are less than 300 ppm, calcium and magnesium are the principal cations, and bicarbonate is the principal anion.

Below Lake Whitney, Aquilla Creek is underlain by the Woodbine Formation of Late Cretaceous Age (cross-bedded ferruginous sandstone, clay, shale, sandy clay with lignite) and water is clear and hard with high calcium, sulfate and bicarbonate content during low flow. The North and Middle Bosque Rivers contain similar waters. The Little River drains Trinity, Washita and Fredericksburg Groups and has hard water, low total dissolved solids and is of calcium bicarbonate type. The Little Brazos is underlain by the Midway Group of Paleocene Age Quaternary alluvium, waters vary in dissolved solids from 275 to 948 ppm, principal cations are sodium and calcium. Bicarbonate is the principal anion.

The Navasota River, in its northern reaches, drains outcrops of Austin Chalk and Eagle Ford Shale of Late Cretaceous Age and the Midway Group of Paleocene Age. Waters near Bryan contain less than 500 ppm dissolved solids and are saline (Rawson, 1967).

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## RIVERS

Physio-chemical data for the basin was collected by Rawson (1967) and Schulze et al (1970). Temperatures were as follows: the Brazos at Waco 8° C in February 1969 and 33° C in August, at Richmond 12° C in December 1968 and 32° C in August 1969, the Clear Fork at Nugent 6° C in February and 28° C in July 1969, Aquilla Creek near Aquilla 6° C in December 1968 and 32° C in July 1969, the Little River at Cameron 10° C in December 1968 and 29° C in August 1969 (Schulze et al 1970). Selected pH values reported were: the Double Mountain Fork at Aspermont 6.9 to 8.1, the Salt Fork at Aspermont 6.6 to 8.2, the White River at Crosbytown 7.2 to 8.2, Mustang Creek at its mouth 7.3 to 7.6, the Middle Bosque near McGregor 6.7 to 7.5, the Little Brazos near Bryan 6.5 to 8.4 (Rawson, 1967). Values recorded for December 1968 and August 1969 were: the Nolan River at Blum, pH 7.5 and 8.7, with dissolved oxygen 11.4 mg/l and 16 mg/l, Aquilla Creek pH 7.7 and 7.6, with dissolved oxygen 11 mg/l and 12 mg/l, the Brazos at Waco pH 7.7 and 7.9, with dissolved oxygen 9.3 mg/l and 7.6 mg/l, the Brazos at Richmond pH 7.8 and 8.1 (in June) with dissolved oxygen 8.6 mg/l and 7.0 mg/l (June), the Little River at Cameron pH 7.0 and 7.3, with dissolved oxygen 10 mg/l and 5.7 mg/l (Schulze et al, 1970). Schulze et al (1970) also sampled waters at the above stations for nitrate, nitrite, phosphorus and specific conductance. Cronin and Wilson (1967) reported on the chemical quality of the lower Brazos River basin.

Clark and Strawn (1969), in a current study of the ecology of the Navasota River, gave physical and chemical data for these waters. Specific conductance ranged from 70 to 2300 micromhos at 12 and 175 mile downstream stations, the pH ranged from 6.8 to 8.3, chlorides varied from 10 ppm to 558 ppm, sulfates varied from 1 ppm to 350 ppm, nitrates from 0.1 ppm to 30 ppm, and total hardness ranged from 20 ppm to 900 ppm.

Rawson, Flugrath and Hughes (1969) investigated the waters entering Possum Kingdom Lake, Leifeste and

Popkin (1968) investigated water chemistry and stratification in Possum Kingdom, Whitney, Hubbard Creek, Proctor and Belton Reservoirs.

The dam forming Possum Kingdom Lake was finished in 1941, the lake has a capacity of 724,700 acre-feet, and covers parts of Jack, Palo Pinto, Stephens and Young Counties. Lake Whitney waters were impounded in 1951, the lake has a capacity of 1,999,500 acre-feet, and is located in Bosque, Hill and Johnson Counties. Lake Hubbard, impounding waters of Hubbard Creek in Stephens County, has a capacity of 515,800 acre-feet. Lake Belton is on the Leon River, was finished in 1954, and its capacity is 1,097,600 acre-feet. Lake Proctor, also on the Leon River, impounded waters in 1965 and has a capacity of 374,200 acre-feet (Dowell and Breeding, 1967).

In July of 1964 thermal and chloride stratification was present in the upper end of Possum Kingdom, with temperature variations of 28° F from top to bottom, and chloride measured 605 ppm at the surface and 1,215 ppm at the bottom. Dissolved solids concentration was 1,350 ppm. In November 1964 some chloride stratification occurred in areas near the dam where temperatures near the bottom were 10.5° F lower than at the surface; in May 1965 chloride concentrations varied from 102 ppm to 690 ppm from top to bottom, and total dissolved solids were 1,350 ppm. Summer inflow to the lake is more saline, therefore of a higher density than impoundment waters, and flows under stored water. Impounded waters are released from the top of the dam also causing increased salinity of the lake itself until winter turnover provides effective mixing of the waters (Leifeste and Popkin, 1968).

Lake Whitney developed chemical and thermal stratification in June 1962 with surface chlorides 200 ppm and bottom values of 550 ppm. In March of 1964 there was little chemical stratification; however, differences were evident in various areas of the lake with 450 ppm chloride near the dam, and 178 ppm of chloride in the upstream regions. The water temperature during this sampling period was near 50° F and the concentration of total dissolved solids was 1,100 ppm. By late

May 1964 minor chemical and thermal stratification appeared, temperatures were 5° F lower at the bottom, and the upper 20 feet was uniform in temperature; by November of that year water was thermally mixed and chloride remained variable in different areas of the lake. Total dissolved solids in November were 800 ppm (Leifeste and Popkin, 1968).

Hubbard Creek Reservoir near Breckenridge was surveyed from September 1963 to December 1964. In September 1963 the temperature was 70° F and varied only 3° F from surface to bottom, chloride content of 136 ppm was uniform throughout the lake. Chloride content in April 1964 measured 144 ppm with vertical uniformity. In November 1964 chemical stratification appeared in the lake, chloride ranged from 21 ppm at the surface to 140 ppm at the bottom, the temperature varied less than 5° F surface to bottom. The lake was completely mixed in December (Leifeste and Popkin, 1968).

Lake Proctor at Comanche was surveyed in 1964. During January no chemical or temperature stratification was evident, in June the lake was thermally stratified but no chemical stratification occurred and chlorides measured 100 ppm. The lake was uniform in temperature and chlorides in November, chloride concentration had decreased to 35 ppm. In August 1962 Lake Belton was thermally stratified with the top 20 feet recording a temperature of 80° F and the bottom temperature 55° F. No chemical stratification appeared. Thermal stratification began in May 1964, chlorides were uniform at 48 ppm and total dissolved solids measured 300 ppm (Leifeste and Popkin 1968).

A study is in progress by Lind (1971) to determine the impact of thermal effluents on Tradinghouse Reservoir. On March 8, 1971, prior to the release of heated water to the reservoir, the waters were uniform at 11° C. On April 12, 1971, after heated water was released, temperatures ranged from 16° C at the dam, 17° C at the intake point, and 27° C at the point of discharge back into the lake. At the same sites in May temperatures were 21.5° C, 23.5° C and 32.0° C, approximately 11° C above the natural reservoir temperatures. Preliminary investigations indicated that phytoplankton showed a

positive response to temperature changes.

The Brazos River basin occupies areas of two biotic provinces, the Kansan and the Texan. The Kansan province is divided into three characteristic districts: The western part of the basin lies in a short grass plains district (high plains on Llano Estacado, Blair and Hubbell, 1938) formed by outwashes of the mountains of New Mexico. The vegetation of this district is dominated by grama Boutelous gracilis, B. racemosa, B. hirsuta, B. curti pendula and buffalo grass Buchloe dactyloides. The escarpment of the high plains forms a fairly sharp boundary with a mixed grass plains district. In addition to the grama and buffalo grass, beardgrasses Andropogon scparius, A. saccharcides, A. furcatus dominate. To the east, this district changes into the Mesquite plains which occupies the exposed Permian of northwestern Texas. This district possesses an extensive association of open stands of Mesquite alternating with fields of grasses including grama, species of three-awn (Aristida) broomweeds (Gutierrezia texana) and gaillardia Gaillardia puchella.

The streams that comprise the Brazos River basin in the Kansan province provide the moisture for various species of trees including oaks, elms, hackberries, maples and cedars. These wooded riparian areas provide the main avenues for dispersal for many animals of the eastern forest. Blair (1950) reported 59 species of mammals, a single species of both turtles and modeles, 14 species of anurans and 31 species of snakes present in the Kansan. Five mammals are restricted to the province including the Vulpes velox, Geomys lutescens, Perognathus flavescens, Dipodomys elator and Peromyscus comanche. The geographic distribution of Dipodomys elator and Peromyscus comanche are restricted to this province. Only one additional species of animal, Natrix harteri, is restricted in geographic range to the Mesquite Plains of the Kansas province.

The Texan province in which the Aquilla Creek impact study is being carried out is discussed in detail in the botanical portion of this report. In contrast to endemic plants, there are no species of

endemic vertebrates present here.

Hill County has been little studied and consequently few records are available even of vertebrates that are regarded as abundant in adjacent counties.

Little biological information is available on the biological fauna of the Brazos River basin.

Biological data for the Navasota River will be included in Clark and Strawn's (loc. cit.) report. They will furnish information on invertebrates, bacterial communities and bottom type patterns. Present information shows distributional patterns which seem to indicate that fauna increase in abundance from the headwaters of the river to its mouth. Some of the tributaries have large numbers of organisms inhabiting their waters, other tributaries have little or no fauna with no obvious chemical reasons apparent in the water. Clark and Strawn (1969) reported 22 forms of "microbial" organisms, most of them belonging to the order Pseudomonadales, few or no coliform bacteria were found. Poirrier (1972) reports Spongillidae in the Navasota River near the San Antonio Road.

Gentner and Hopkins (1966) reported the small fingernail clam *Musculium ferrissi* common in the Little Brazos River prior to the 1964 drought, but rare in 1966. Two species, *Arcidens confragosus* and *Anodonta corpulenta*, found in their later survey were not found prior to 1964 (Gentner and Hopkins, 1966). Farrell (1965) collected Cladoceran species in Brazos County waters including the Brazos, Little Brazos, and Navasota Rivers. He reports four species from the Brazos, five species from the Little Brazos, ten species from the Navasota River; collections included *Sididae*, *Daphnidae*, *Bosminidae*, *Macrothricidae* and *Chydoridae*. Farrell (1965) found no stable communities of plankton present when rivers were high and flowing rapidly, communities only developed during rather dry periods. Tinkle and Conant (1961) report a new sub-species of *Natrix harteri* found in the Brazos near Palo Pinto.

## RESULTS AND DISCUSSION

Phylum Protozoa.

*Vorticella* spp.
*Arcella* spp.
*Paramecium* spp.
*Diffulgia*
*Bodo or Monas*

Protozoans were not obtained in plankton tows in open water. Specimens were only obtained in localized situations, in isolated pools or in isolated environments such as in clumps of aquatic vegetation.

Phylum Porifera (Sponges).

No sponges were obtained. Cheatum and Harris (1953) have observed that size and growth and occurrence of sponges are dependent on high organic content of the water and low turbidity. These two factors probably account for the apparent lack of sponges in this study.

Phylum Coelenterata.

No Coelenterata were collected in this study.

Phylum Platyhelminthes.

*Dalyellia armigera*. This species of flatworm is a free living turbellarian. Specimens were obtained under rocks in each collection site.

Phylum Rotatoria (Rotifers).

*Brachionus caudatus*
*Asplanchina* sp.
*Keratella quadrata*
*Notholca* sp.

The number of individuals collected in the study represent the dominant species. Their numbers, however, are much lower than recorded elsewhere in the state. The genera *Brachionus*, *Asplanchina*, *Keratella* and *Notholca* are among the most coherent of rotifers

(Pennak, 1953; Reid, 1961). Many genera of rotifers have been reported in Texas as occurring only during winter months.

Phylum Annelida.

*Diplocardia sandersi*
*Limnodilis* spp.
*Tubifex tubifex*

The species of *Limnodilis* and *Tubifex tubifex* are common members of Texas waters. Their widespread occurrence is correlated with their ability to waters. Although specimens were obtained at all sites, their occurrence was higher in Site 1 where pools were isolated from the channel.

Phylum Mollusca.

*Quadrula fustulosa*
*Quadrula quallrula*
*Amblema plicata*
*Lampsilis fasciata*
*Proptera purpurata*
*Anodonta corpulenta*
*Sphaerium transversum*
*Musculium fenissi*
*Physa virgata*
*Helosoma trivolris lentum*
*Mesodon roemeri*
*Rabdotus dealbatus*
*Polygyra texasiana*
*Helicina orbiculata tropica*

The numbers of aquatic mollusks are not high if the numbers recorded in macrobenthos sampling are utilized. The two common land snails *Mesodon roemeri* and *Rabdotus dealbatus* are both numerous in the terrestrial surveys.

Phylum Arthropoda.

Class Arachnida.

_Unionicola_ sp. (mites)
_Dermacenter varabilis_

Class Arachnida.

_Centraroides vittatus_
_Latrodectus mactans_
_Lycosa rabida_
_Pencetia abboti_

Class Diplopoda.

_Aniulus_ sp.

Class Crustacea.

Isopoda
_Armadillidium vulgare_

Decopoda
_Procambarus simulans_

Copepoda
_Cyclops_

Cladocera
_Daphnia_
_Polyphemus_

Insecta
_Chaoborus_ spp.
_Tendipes_ spp.
_Tipula triplex_
_Hydrophilus_ spp.
_Vespa_ sp.
_Bombu_ sp.
_Apis mellifica_
_Mischocyttaras flavitarsus_
_Upis ceramboide_
_Erax_ spp.

*Asilidusge* spp.
*Erox* spp.
*Tabanus* spp.
*Reduvius* spp.
*Gerris conformis*
*Gelastocoris oculatus*

Grasshoppers
*Melanophine differentialis*
*M. femor-rubium*
*Brachystola*
*Acantherus piperatus*
*Achurum sumichrasti*
*Neoconocephatus ensiger*
*Rhammotocercus viatoria*
*Acrydius arenosum*
*Gphaygerion bolli*
*Hippiscus rugosus*
*Pardalophora phoenicoptera*
*Tomontus ferruginusus*
*Sparagemon bolli*
*Hesperotehix viridis*
*Oecanthus nivus*
*Scudderia furcata*
*Gryllus assimilus*

Dragonflies
*Libellula needhami*
*Plathemis lydia*
*Aeschana dugesi*
*Libellula saturata*
*L. incesta*

Butterflies
*Strymon melinus*
*Melitaea gorgone*
*Piers lavinia*
*Chloripple montis*
*Chlosyne lacinia*
*Libythea bachmoni*
*Limenitis archippas*

Mosquitoes

*Aedes nigromaculis*
*Aedes sollicitans*
*Aedes vexans*
*Anopheles quadrimaculatus*
*Culex tarsalis*
*Culex pipiens*

Many insects belonging to the orders listed below were collected, and sent to specialists. Their exact identities are unknown.

Ephemeroptera
*Hexagenia* spp.

Dictyoptera (Cockroaches, mantises and walking sticks)

Isoptera (Termites, white ants)

Plecoptera (Stoneflies)

Hemiptera (Bugs)

Homoptera (Cicadas, leafhoppers, aphids, scale insects)

Heteroptera

Hymenoptera (Sawflies, ants, bees, wasps)

Coleoptera (Beetles, weevils)

Diptera (Flies)

Lepidoptera (Butterflies, moths)

Water Quality:

Temperature. The temperature (Table 24) ranged from 23.0 to 28.4. There was little variation in temperature in any stream. Lower temperatures, however, were recorded in Alligator Creek than elsewhere.

Dissolved Oxygen. The one most important limiting factor for aquatic life, dissolved oxygen, ranged in values from 0.2 ppm to 4.2 ppm (Table 25). All streams are poor in oxygen. Only Alligator Creek with 4.2, 4.1 and 3.8 ppm (Site 7) and Aquilla Creek (upper regions) with 4.1, 4.7 and 4.6 ppm of oxygen exceeded the minimum standard of 4.0 ppm as defined by the Texas Water Quality Board (Brazos River Authority, 1970).

Hydrogen Ion. Hydrogen ion concentrations (Table 26) ranged from 7.0 to 8.2. Though generally high by fresh water standards as described by Reid (1961), the values are consistent with the geology of the area and agree with values for Possum Kingdom Reservoir, Lake Whitney (Leifeste and Popkin, 1968) and the Brazos River (Rawson, 1967).

Table 24. Temperature

| Site | June | Month July | August |
| --- | --- | --- | --- |
| 1 | 27.0 | 29.3 | 28.4 |
| 2 | 23.0 | 26.0 | 25.5 |
| 3 | 24.0 | 26.3 | 25.0 |
| 4 | 25.0 | 26.4 | 25.1 |
| 5 | 25.6 | 26.3 | 26.2 |
| 6 | 25.5 | 26.1 | 25.0 |
| 7 | 24.0 | 24.2 | 24.3 |

Table 25. Dissolved Oxygen (ppm)

| Site | June | Month July | August |
| --- | --- | --- | --- |
| 1 | 2.4 | 2.0 | 2.2 |
| 2 | 2.1 | 2.0 | 2.5 |
| 3 | 4.1 | 4.7 | 4.1 |
| 4 | 3.1 | 3.0 | 3.2 |
| 5 | 3.2 | 1.0 | 1.3 |
| 6 | 2.5 | 2.4 | 2.5 |
| 7 | 4.2 | 4.1 | 3.8 |

Table 26. Hydrogen Ion Concentration (pH)

| Site | June | Month July | August |
| --- | --- | --- | --- |
| 1 | 8.2 | 7.8 | 8.0 |
| 2 | 7.6 | 7.0 | 7.4 |
| 3 | 7.0 | 7.3 | 7.2 |
| 4 | 7.4 | 7.3 | 7.6 |
| 5 | 7.4 | 7.4 | 7.5 |
| 6 | 7.6 | 7.5 | 7.6 |
| 7 | 7.7 | 7.6 | 7.7 |

Carbon Dioxide. $CO_2$ is a measure of the decomposition and respiration occurring at various regions of the streams involved in this study. The levels of $CO_2$ were consistently higher at Cobb Creek (Station 5) and beside the Hillsboro Sewage Plant (Station 1) than elsewhere. The lowest values of 4 to 16 were obtained in Alligator Creek (Table 27).

Alkalinity. Alkalinity is measured in ppm $CaCO_3$. The values listed in Table 28 represent both carbonate and bicarbonate alkalinity. The ranges observed are moderate for Texas waters.

Total Hardness. Total hardness is measured as ppm of all polyvalent metal ions, but reflect particularly calcium and magnesium. The results obtained in this study (Table 28) reflect that the waters are only moderately hard by the scheme of classification offered by Rawson (1967).

Conductivity. Specific conductance ranged from 850 to 1100 (Table 30). Slightly higher values were obtained for Possum Kingdom Reservoir and Lake Whitney (Leifeste and Popkin, 1968). These readings reflect the high mineral content of the drainage.

Table 27. Carbon Dioxide (ppm)

| Site | June | Month<br>July | August |
|---|---|---|---|
| 1 | 88 | 98 | 80 |
| 2 | 25 | 30 | 30 |
| 3 | 25 | 28 | 26 |
| 4 | 30 | 26 | 32 |
| 5 | 80 | 75 | 80 |
| 6 | 25 | 35 | 28 |
| 7 | 4 | 12 | 16 |

Table 28. Alkalinity (ppm $CaCO_3$) ppm

| Site | June | Month<br>July | August |
|---|---|---|---|
| 1 | 110 | 100 | 120 |
| 2 | 120 | 100 | 80 |
| 3 | 120 | 130 | 100 |
| 4 | 100 | 100 | 125 |
| 5 | 100 | 100 | 100 |
| 6 | 135 | 110 | 130 |
| 7 | 110 | 130 | 115 |

Table 29. Total Hardness (ppm $CaCO_3$)

| Site | June | Month<br>July | August |
|---|---|---|---|
| 1 | 380 | 320 | 420 |
| 2 | 390 | 420 | 440 |
| 3 | 350 | 390 | 430 |
| 4 | 420 | 410 | 400 |
| 5 | 450 | 410 | 460 |
| 6 | 420 | 450 | 480 |
| 7 | 370 | 400 | 420 |

Table 30. Conductivity (ppm NaCl)

| Site | June | Month<br>July | August |
|---|---|---|---|
| 1 | 800 | 920 | 850 |
| 2 | 950 | 1000 | 1000 |
| 3 | 960 | 975 | 950 |
| 4 | 900 | 950 | 975 |
| 5 | 1100 | 1000 | 1075 |
| 6 | 980 | 950 | 1000 |
| 7 | 950 | 950 | 1000 |

Nitrogen Compounds. The nitrogen compounds examined in this study include ammonium ions, nitrate ions and nitrite. The ammonium ions ranged from 1.58 ppm in the area near the sewage treatment plant and at the stagnant pcol on Cobb Creek (Table 31). These rates are not high. Nitrate values (Table 32) were roughly uniform ranging from 1.00 to 3.30 ppm. These levels may have been elevated from nitrates resulting from runoff of cultivated fields. Nitrite values were less than 0.016 and are relatively uniform at all sites during the three month sampling period (Table 33).

Phosphates. The phosphate readings reported in Table 34 include both organic and inorganic phosphates. The highest value occurs at Site 1 near the sewage plant, but it is considerably lower than reported elsewhere in the state.

Table 31. Nitrogen Compounds, Ammonium Ions

| Site | Month June | July | August |
|---|---|---|---|
| 1 | 1.00 | 1.40 | 1.58 |
| 2 | 0.10 | 0.20 | 0.25 |
| 3 | 0.30 | 0.15 | 0.30 |
| 4 | 0.30 | 0.25 | 0.40 |
| 5 | 1.4 | 1.0 | 1.50 |
| 6 | 0.35 | 0.40 | 0.40 |
| 7 | 0.85 | 0.40 | 1.00 |

Table 32. Nitrates (ppm)

| Site | Month June | July | August |
|---|---|---|---|
| 1 | 1.40 | 1.00 | 1.50 |
| 2 | 1.20 | 2.20 | 1.00 |
| 3 | 1.00 | 2.00 | 1.30 |
| 4 | 2.40 | 2.00 | 2.20 |
| 5 | 3.00 | 2.90 | 3.30 |
| 6 | 2.80 | 2.90 | 2.90 |
| 7 | 2.00 | 2.20 | 1.90 |

Table 33. Nitrites (ppm)

| Site | Month June | July | August |
|---|---|---|---|
| 1 | 0.008 | 0.008 | 0.007 |
| 2 | 0.002 | 0.002 | 0.005 |
| 3 | 0.011 | 0.012 | 0.016 |
| 4 | 0.010 | 0.012 | 0.010 |
| 5 | 0.008 | 0.006 | 0.008 |
| 6 | 0.006 | 0.008 | 0.010 |
| 7 | 0.015 | 0.012 | 0.012 |

Table 34. Total Phosphates (ppm)

| Site | Month June | July | August |
|---|---|---|---|
| 1 | 0.19 | 0.29 | 0.20 |
| 2 | 0.04 | 0.02 | 0.03 |
| 3 | 0.10 | 0.06 | 0.12 |
| 4 | 0.10 | 0.08 | 0.11 |
| 5 | 0.08 | 0.08 | 0.06 |
| 6 | 0.00 | 0.01 | 0.01 |
| 7 | 0.04 | 0.08 | 0.04 |

Sulfates. Sulfates are presented in Table 35. The levels appeared relatively uniform. If this trend is continued throughout the year the presence of up-stream gypsum formations could be expected (Rawson, 1967).

Table 36. Sulfates (ppm)

| Site | Month | | |
|---|---|---|---|
| | June | July | August |
| 1 | 175 | 160 | 200 |
| 2 | 120 | 135 | 130 |
| 3 | 100 | 120 | 110 |
| 4 | 125 | 125 | 130 |
| 5 | 120 | 140 | 140 |
| 6 | 115 | 120 | 140 |
| 7 | 110 | 135 | 120 |

Sodium. The amounts of sodium at various sites is presented in Table 36. High values were obtained at Sites 1 and 5. The high value obtained at Site 1 can be expected due to the sewage outlet. The value obtained from 3 miles downstream at Site 2 is significantly lower, indicating a loss either by uptake by vegetation or by dilution. The high value at Site 5 may be explained by the stagnant nature of the water.

Potassium. The levels of potassium at six sites is presented in Table 37. The levels are all reasonable The elevation at Site 5 is representative of an evaporating pool.

Calcium. The calcium content of six samples is presented in Table 38. The calcium content is moderate with a high reading occurring at Site 5.

Magnesium. The levels of magnesium recorded at 6 sites are listed in Table 39. All levels were low to moderate except Site 5 where a high level was obtained.

Table 36. Sodium (ppm)

| Site | August |
|---|---|
| 1 | 253.0 |
| 2 | 65.2 |
| 3 | 21.2 |
| 4 | 46.8 |
| 5 | 382.0 |
| 6 | no sample |
| 7 | 17.7 |

Table 37. Potassium (ppm)

| Site | August |
|---|---|
| 1 | 4.9 |
| 2 | 3.5 |
| 3 | 2.3 |
| 4 | 2.6 |
| 5 | 18.8 |
| 6 | no sample |
| 7 | 2.5 |

Table 38. Calcium (ppm)

| Site | August |
|---|---|
| 1 | 62.3 |
| 2 | 74.3 |
| 3 | 75.0 |
| 4 | 74.6 |
| 5 | 373.0 |
| 6 | no sample |
| 7 | 67.7 |

Table 39. Magnesium (ppm)

| Site | August |
|---|---|
| 1 | 3.4 |
| 2 | 2.2 |
| 3 | 1.8 |
| 4 | 1.9 |
| 5 | 20.0 |
| 6 | no sample |
| 7 | 1.6 |

Iron. Iron is found in values less than 0.4 ppm (Table 40). Such low values are common in the Texas waters (Bullock and Fruh, 1972; Rawson, 1968).

Lead. Lead is recorded to be present in less than 0.1 ppm (Table 41). The values are consistent with lead content of other similar waters in Texas.

Table 40. Iron (ppm)

| Site | August |
|---|---|
| 1 | 0* |
| 2 | 0 |
| 3 | 0.4 |
| 4 | 0.3 |
| 5 | 0 |
| 6 | no sample |
| 7 | 0 |

Table 41. Lead (ppm)

| Site | August |
|---|---|
| 1 | 0* |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| 5 | 0 |
| 6 | 0 |
| 7 | 0 |

*Less than 0.1 ppm.

_Phytoplankton_. Phytoplankton counts varied considerably with month and site (Table 42). The predominant plankter was the green algae _Actinastrum gracillimum_. The remainder of the cells were diatoms and other phytoplankton genera. Other than the dominant plankter, the other species were not specifically identified. No linear distribution gradents could be detected. The highest counts were obtained consistently at Site 5 at Cobb Creek where the water was not flowing.

_Zooplankton_. Total counts of 300 plankton for the three periods of sampling are presented in Table 43. The zooplankton are limited primarily to a few species of rotifers and copepods. The populations are small; only in Site 5 where the water was not flowing were samples obtained that indicated a relatively large population. The dominant organisms were copepods of the genus _Cyclops_. Rotifers of the genera _Keratella_ and _Notholca_ were obtained at each site, but in reduced numbers. In a limnological survey of Lake Granbury, Mecom (1972) reported large standing crops of rotifers in the recently constructed reservoir, Lake Granbury.

The flowing water of high silt content may influence the reduction of the rotifers observed in this study. Mecom (1972) reported that the productivity dropped sharply in the summer months. Inasmuch as samples for this study were collected only in the summer months, the productivity of these waters cannot be adequately ascertained.

Table 42. <u>Phytoplankton</u> (cells per liter)

| Site | Date<br>June | <br>July | <br>August |
|---|---|---|---|
| 1 | 2,801,300 | 1,905,411 | 2,050,375 |
| 2 | 1,450,103 | 1,267,443 | 1,431,561 |
| 3 | 299,500 | 211,480 | 416,960 |
| 4 | 1,406,844 | 807,610 | 1,315,283 |
| 5 | 4,800,000 | 6,470,000 | 5,489,110 |
| 6 | 1,060,705 | 1,005,699 | 945,566 |
| 7 | 580,888 | 470,333 | 250,600 |

Table 43. <u>Zooplankton</u> (organisms per liter)

| Site | Date<br>June | <br>July | <br>August |
|---|---|---|---|
| | 19 | 22 | 10 |
| 1 | 6 | 10 | 15 |
| 2 | 22 | 40 | 35 |
| 3 | 20 | 29 | 26 |
| 4 | 15 | 15 | 14 |
| 5 | 130 | 145 | 115 |
| 6 | 30 | 21 | 20 |
| 7 | 41 | 64 | 60 |

Bacteria. Total plate counts at various sites are presented in Table 44. Included are the numbers of coliform, E. coli and fecal streptococci. The highest levels of organisms were obtained at Site 1, just below the Hillsboro station. This reading includes 11,000/ml of coliform. 460/ml E. coli and 2,800/ml fecal streptococci. After roughly 3 miles, at Site 2, the total count decreases by 4 times although E. coli counts increase (from 460 to 1,500/ml).

Counts are equally high at Site 5, Cobb Creek, in samples taken from non-flowing pools. This count is undoubtedly influenced by the cattle which use the pools for water. Levels of bacteria at all other sites indicate a reduction in numbers throughout the streams. The levels observed are all below the standard for fresh water.

Table 44. Bacteria (in organisms/ml.)

| Site | Total Numbers | Coliform | E. coli | Fecal Strepto-cocci |
|---|---|---|---|---|
| 1 | 5,775,000 | 11,000 | 460 | 2,800 |
| 2 | 1,132,000 | 11,000 | 1,500 | 550 |
| 3 | 460,000 | 1,100 | 150 | 100 |
| 5 | 4,100,000 | more than 1,100 | 1,100 | 600 |
| 6 | 1,020,000 | 750 | 150 | 200 |
| 7 | 2,216,000 | 1,100 | 150 | 50 |

*Macrobenthos*. Total organism counts of macrobenthic forms are reported in Table 45. Their distributions depend primarily on bottom sediment type. The streams under examination in this study are difficult to characterize by a study of macrobenthos. Silting is heavy and deep deposits of silt occur. Samples obtained from such areas, especially if the water is not running as in site 5 at Cobb Creek large populations of *Chaoborus* (dipteran). *Physa virgata* and *Tendipes* (dipteran) occurred. All forms are tolerant of waters with low $O_2$ levels. At site 3, large numbers of fingernail clams *Spharium transversum* occurred in the gravel banks of the stream. Their occurrence was limited elsewhere in the streams under study by the silt. A second fingernail clam *Musculium ferrisei* occurred in mud deposits but was not as numerous. Although many invertebrates were obtained, diversity was not expected as many forms are not tolerant to warm summer temperatures of these streams.

Table 45. Macrobenthos (organisms per meter$^2$)

| Site | June | July | August |
|---|---|---|---|
| 1 | 130 | 160 | 330 |
| 2 | 85 | 70 | 104 |
| 3 | 545 | 291 | 773 |
| 4 | 107 | 80 | 85 |
| 5 | 245 | 617 | 318 |
| 6 | 55 | 82 | 79 |
| 7 | 83 | 68 | 77 |

*Turbidity*. The amount of suspended inorganic and organic material in water is an indication of the optic properties of water and greatly affects productivity. High turbidity readings effectively reduce penetration and hence reduce light available for fixations by photosysthesis in primary producers. As documented by Stevens, (1951) the Brazos River carries a heavy silt load. Turbidity readings on Hackberry Creek and Aquilla Creek after confluence with Hackberry, give high readings (Table 46). The readings in July and August were taken within a week after rains in the area which may have influenced these higher readings.

Relative transparency. Relative transparency ranges from 6-18 inches. This examination of water quality is also a quality of the amount of salt in the streams examined. From the values presented in Table 47 the silt levels are heavy. Silt levels appear to be enhanced by considerable erosion in the bottom land. Such erosion is detrimental. It reduces water transparency, reduces photosynthesis, handicaps predators that feed on sight and clogs the filtration apparatus of various invertebrates. Silted streams invariably result in impoverished faunas.

Kendeigh (1961) suggests artificial dams, if used to assist cleaning of the stream, should be small and located where the drainage begins in the headwaters of the drainage. Stevens (1951) reported that Possum Kingdom was an effective silt trap but permitting 95% of all silt entering the dam to be settled out.

Table 46. Turbidity (Jackson Trubidity Units)

| Site | June | July | August |
|---|---|---|---|
| 1 | 75 | 95 | 105 |
| 2 | 110 | 120 | 160 |
| 3 | 70 | 75 | 80 |
| 4 | 140 | 130 | 160 |
| 5 | 150 | 145 | 120 |
| 6 | 100 | 95 | 130 |
| 7 | 75 | 70 | 80 |

Table 47. Relative Transparency (inches)

| Site | June | July | August |
|---|---|---|---|
| 1 | 12 | 15 | 17 |
| 2 | 6 | 7 | 3 |
| 3 | 8 | 7 | 8 |
| 4 | 8 | 8 | 9 |
| 5 | Water too shallow for reading. | | |
| 6 | 8 | 8 | 9 |
| 7 | 18 | 16 | 14 |

An examination of invertebrates from various regions of the study site show that the riparian habitat along each of the streams to be occupied by more organisms in both numbers and species diversity than any other area in the study site. The high values obtained for numbers of individuals in the grazed fields is represented mainly by Orthroptera (grasshoppers). This is best indicated by the small number of taxa as opposed to the riparian habitat.

Table 25. Distribution of invertebrates in sectors of the study site.

| Location | # Individuals | # Taxa |
|---|---|---|
| Mesquite Ridge | 1400 | 78 |
| Cultivated Field | 3006 | 31 |
| Grazed Field | 546 | 18 |
| Oak-hickory woods (riparian) | 2300 | 105 |

Pesticide use in the immediate area to be impounded is difficult to quanify. Discussions with local farmers and county agents indicate that pesticide use is not heavy and will probably not be of concern if erosion into the impoundment can be controlled.

In summary, the preliminary survey indicates that the streams are following a succession related to the influence of man's impact. The streams are relatively clean and generally well oxygenated except in standing pools. Carbon dioxide levels are low except in areas of active decomposition. The hydrogen ion concentrations are typical of alkaline Texas waters and they do not vary significantly along the streams. Alkalinity and total hardness are moderate. Phosphates, nitrates and ammonium ions are present in only moderate amounts.

Turbidity readings are generally high, particularly in a season of drought. This particular observation may be important in determining the productivity of the streams based upon summer plankonic populations and any speculations about the advisability of changing a water course.

The impoverished fauna obtained in the study are probably related to factors caused by increased siltation. For reasons presented elsewhere siltation effectively selects for species that are non-filter feeders or predators that do not rely on sight for obtainin prey. Such selection eventually reduces the carrying capacity of the water. The above mentioned species are important components of the basic levels in aquatic food chains. It must also again be emphasized that these observations are based only on samples collected during three months of the summer when populations and diversity of species are typically at their lower levels. Furthermore, the data is less reliable due to the lack of normal rainfall during and preceeding the study.

It is difficult to speculate on changes in water quality based on samples obtained during a summer of drought. As pointed out earlier siltation is high in all streams and probably is the principal factor in reducing the fauna. Impoundment of the streams would likely improve the water quality both above and below the dam by sewing as an effective silt trap.

The following recommendations are made in regard to future planning. Of the dam sites listed by the Corp of Engineers only those sites which retard water on Alligator, Cobb, upper Aquilla and Hackberry should be constructed. This recommendation would allow the small dam to act as setting basins for silt and effectively reduce the silt deposits in the main stream. Smaller dams on the upper watersheds could retard the loss of soil and consequently reduce the probability of rapid filling of those major dams. This recommendation is made with the reservation that the remainder of the stream (Aquilla after its juncture with Hackberry) not be channelized.

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## FISHES OF THE AQUILLA CREEK BASIN

Aquilla Creek and its tributaries, Cobb Creek and Hackberry Creek, extend through a portion of game area 5 which contains the east and west cross timbers as well as the grand prairie (Anom., 1945). Each of these streams may be intermittent prior to the confluence of Hackberry and Aquilla Creeks. From this point toward the Brazos River there was a rather slow, continuous flow during the summer of 1972.

The entire watershed is subject to rather intense runoff, due to the high percentage of it that is under cultivation. This runoff causes flash flooding along Aquilla Creek and its tributaries. Moreover, runoff water in this region carries a severe silt load. This silt load dramatically increases turbidity of the streams following each rain. Usually flood waters recede rapidly, but the turbidity persists for some time. The settling of silt and clay particles, which reflect the primary soil constituents of the watershed, leaves a silt deposit on the bottom of these streams. In certain localized portions of these streams, however, the flow is sufficient to produce clean sandy and gravelly areas. These are usually found in the form of rather slow moving riffles. The banks of these three streams are generally deep and steep, and they are covered by silt and clay particles.

Checklist of fish species reported from the middle Brazos River Basin, including the proposed Aquilla Creek Reservoir Area. The species included on this list are taken primarily from the investigations of Hubbs (1972) and from on-site collections involving the use of both fine and large mesh seins. The on-site investigations failed to produce any species not included in Hubbs' report.

| Scientific Name | Common Name |
| --- | --- |
| Lepisosteidae | |
| *Lepisosteus oculatus* | Spotted gar |
| *Lepisosteus osseus* | Longnose gar |

Clupeidae

| | |
|---|---|
| _Dorosoma petenense_ | Threadfin shad |
| _Dorostoma cepedianum_ | Gizzard shad |

Characidae

| | |
|---|---|
| _Astyanax fasciatus_ | Ganded tetra |

Cyprinidae

| | |
|---|---|
| _Cyprinus carpio_ | Carp |
| _Carassius auratus_ | Goldfish |
| _Notemigonus crysoleucas_ | Golden shiner |
| _Opsopoedus emiliae_ | Pugnose minnow |
| _Hybopsis aestivalis_ | Speckled chub |
| _Phenacobilis mirabilis_ | Suckermouth minnow |
| _Notropis percobromus_ | Plains shiner |
| _Notropis oxyrhynchus_ | Sharpnose shiner |
| _Notropis shumardi_ | Silverband shiner |
| _Notropis potteri_ | Chub shiner |
| _Notropis buccala_ | Smalleye shiner |
| _Notropis venustus_ | Spottail shiner |
| _Notropis lutrensis_ | Red shiner |
| _Notropis volucellus_ | Mimic shiner |
| _Notropis buchanani_ | Ghost shiner |
| _Hybognathus nuchalis_ | Silvery minnow |
| _Hybognathus placitus_ | Plains minnow |
| _Pimephales vigilax_ | Parrot minnow |
| _Pimephales promelas_ | Fathead minnow |
| _Campostoma anomalum_ | Stoneroller |

Catastomidae

| | |
|---|---|
| _Cycleptus elongatus_ | Blue sucker |
| _Ictiobus bubalus_ | Smallmouth buffalo |
| _Carpiodes carpio_ | River carpsucker |
| _Moxostoma congestum_ | Gray redhourse |

Ameiuridae

| | |
|---|---|
| _Ictalurus punctatus_ | Channel catfish |
| _Ictalurus furcatus_ | Blue catfish |
| _Ictalurus melas_ | Black bullhead |
| _Ictalurus natalis_ | Yellow bullhead |

| | |
|---|---|
| *Pylodictus olivaris* | Flathead catfish |
| *Schilbeodes gyrinus* | Tadpole madtom |

Anguillidae

| | |
|---|---|
| *Anguilla rostrata* | American eel |

Cyprinodontidae

| | |
|---|---|
| *Fundulus kansae* | Plains killifish |
| *Zygonectes notatus* | Blackstripe topminnow |

Poeciliidae

| | |
|---|---|
| *Gambusia affinis* | Mosquitofish |

Percichthyidae

| | |
|---|---|
| *Morone chrysops* | White bass |

Centrarchidae

| | |
|---|---|
| *Micropterus puntulatus* | Spotted bass |
| *Micropterus salmoides* | Largemouth bass |
| *Chaenobryttus gulossus* | Warmouth |
| *Lepomis punctatus* | Spotted sunfish |
| *Lepomis microlophys* | Readear sunfish |
| *Lepomis macrochirus* | Bluegill |
| *Lepomis humilis* | Orangespotted sunfish |
| *Lepomis megalotis* | Longear sunfish |
| *Lepomis marginatus* | Dollar sunfish |
| *Pomoxis annularis* | White crappie |
| *Pomoxis nigromaculatus* | Black crappie |

Percidae

| | |
|---|---|
| *Hadropterus scierus* | Dusky darter |
| *Hadropterus shumardi* | River darter |
| *Percina caprodes* | Logperch |
| *Percina macrolepida* | Big scale logperch |
| *Etheostoma spectabile* | Orangethroat darter |

Sciaenidae

| | |
|---|---|
| *Aplodinotus grunniens* | Freshwater drum |

Mugilidae

*Mugil cephalus* Striped mullet

The proposed reservoir would change aquatic habitats from lotic to lentic ones. This change would most dramatically affect those fish species present that are usually confined to small streams in areas of moderate stream flow. Those species present in the regions of the Aquilla Creek watershed that fit this category are:

| | |
|---|---|
| *Campostoma anomalum* | Stoneroller |
| *Hadropterus shumardi* | River darter |
| *Lepomis megalotus* | Longear sunfish |
| *Lepomis punctatus* | Spotted sunfish |
| *Percina macrolepida* | Big scale logperch |
| *Notropis lutrensis* | Red shiner |
| *Notropis venustus* | Spottail shiner |

*Notropis lutrensis* was collected in each sample taken from the three creeks studies. Studies conducted by Cross (1967) indicate that this species is indicative of habitats in which few other types of fish occur. Onsite collections during the summer of 1972 in the Hill County area tend to substantiate this view. The proposed impoundment would probably eliminate the species previously listed from the upper Aquilla Creek watershed. Very little water is to be found in the water courses in question above the full reservoir level of the proposed impoundment. However, each of these species enjoys a rather wide distribution and seems to be in no imminent danger of extinction.

Most of the other species on the checklist should satisfactorily survive the transition to a lacunal situation. This should result in increased populations of fishes present. Normally the ecosystem is initially conductive to the emergence of game species as dominants. Successional eutrophication, however, generally favors less desirable species, and the result is an overall increase in standing crop favoring coarse species (Jenkins, 1957).

Fish productivity in the proposed reservoir should be affected by the nature of the shoreline as well as the surrounding terrain. Because the reservoir will occupy primarily land that has been used for agricultural purposes, the shoreline will be initially rather exposed. Furthermore, a good portion of the runoff entering the impoundment will be from plowed and row-cropped land. This, considered in the light of clay and silt content of the soils of the region, should produce a high concentration of suspended particles and turbidity. This should produce two important results: (1) a slowing of the rate of eutrophication and accompanying fish productivity, (2) an ecosystem that would tend to favor increased populations of the bottom-feeding, less desirable fish species (e.g., *Cyprinus carpio*, *Ictiobus bubalus*, *Carpiodes carpio*, and *Pylodictus olivaris*).

The turbidity conditions of the reservoir may also be affected by the direction in which the lake lies and the relation of this direction to prevailing winds. The proposed impoundment will offer a long reach in a generally southeast to northwest direction, particularly along the Aquilla Creek arm. This should further tend to keep the lake in a condition of rather high turbidity.

This study indicates the presence of no rare or endangered species.

The predominate game species in the proposed impoundment would be:

| | |
|---|---|
| *Ictalurua punctatus* | Channel catfish |
| *Micropterus salmoides* | Largemouth bass |
| *Morone chrysops* | White bass |
| *Pomoxis annularis* | White crappie |
| *Pomoxis nigromaculatus* | Black crappie |

In addition, other species that have a rather high human food value are:

| | |
|---|---|
| *Aplodinotus grunniens* | Freshwater drum |
| *Ictalurus melas* | Black bullhead |
| *Ictalurus natalis* | Yellow bullhead |

| | |
|---|---|
| *Ictiobus bubalus* | Smallmouth buffalo |
| *Pylodictus olivaris* | Flathead catfish |

The fish population of the channel of Aquilla Creek below the proposed dam could be affected in one of two ways. If the water entering the reservoir is of sufficient quantity to maintain a continuous flow over the spillway the water of the creek below the dam should encourage an ecosystem favoring the presence of fishes of the Brazos River basin that flourish in relatively clear flowing water. However, if evaporation and seepage from the reservoir is such that no flow is maintained below the dam the creek will be at best intermittent and could become completely dry. Perhaps further study regarding evaporation and seepage from the proposed impoundment compared to drainage parameters is worthy of study.

## BIRDS OF THE AQUILLA CREEK BASIN

The Aquilla Creek watershed is divided into six types of generalized habitats that influence the presence of birds, reptiles, amphibians and mammals: (1) deciduous forests of the flood plain, (2) scrub oak of the east cross timbers on ridges and uplands, (3) mesquite-grassland in generally well-drained areas, (4) cleared pastures, (5) plowed crop land, (6) the aquatic habitats of the creeks that run through the area.

Of these habitats, the thin strip of hardwood forest on the flood plains would be the most radically affected by an impoundment. This habitat would completely disappear in the area that is inundated.

A total of 257 species of birds are known to occur in Hill County (Kirby, 1972). Other species have been recorded there in the distant past or upon very rare occasions; for pragmatic reasons the following summary includes only those species that can be considered to inhabit the area on a regular basis. This list was taken from one prepared by Mr. Hal P. Kirby, Director of the Dallas Museum of Natural History. Listings are in accordance with the American Ornithological Union species list.

Summary of occurrence and relative abundance of the birds of Hill County, Texas, showing predicted short-term population changes following the inundation of a major portion of the Aquilla Creek watershed.

| Species* | Relative Abundance[a] Sp. | Su. | F. | W. | Preferred Habitat[b] | Predicted Population Change[c] |
|---|---|---|---|---|---|---|
| Gaviidae | | | | | | |
| <u>Gavia immer</u>: Common Loon | R | | R | R | W | + |
| <u>Gavia stellata</u>: Red-throated Loon | R | | R | R | W | + |

| | | | | | | |
|---|---|---|---|---|---|---|
| Podicipedidae | | | | | | |
| *Podiceps auritus*: Horned Grebe | R | | R | R | W | + |
| *Podiceps caspicus*: Eared Grebe | U | | U | U | W | + |
| *Podilymbus podiceps*: Pied-billed Grebe* | C | U | C | C | W,M | + |
| Pelecanidae | | | | | | |
| *Pelecanus erythrorhynchos*: White Pelican | C | | C | | W | + |
| Phalacrocoracidae | | | | | | |
| *Phalacrocorax airitus*: Doublecrested Cormorant | U | R | U | R | W,M | + |
| *Phalacrocorax olivaceus*: Mexican Cormorant | U | R | U | R | W,M | + |
| Anhingidae | | | | | | |
| *Anhinga anhinga*: Water Turkey* | U | U | U | | W,M | + |
| Ardeidae | | | | | | |
| *Ardea herodias*: Blue Heron* | C | C | C | U | Sh,M | + |
| *Casmerodius albus*: American Egret* | A | A | A | U | Sh,M | + |
| *Leucophoyx thula*: Snowy Egret* | U | U | U | | Sh,M | + |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Hydranassa tricolor*: Louisiana Heron | | | U | | Sh,M | + |
| *Florida caerulea*: Little Blue Heron* | C | C | U | | Sh,M | + |
| *Bubucus ibis*: Cattle Egret* | C | C | C | R | O,M | + |
| *Nycticorax nycticorax*: Black-crowned Night Heron* | U | U | U | R | Sh,M | + |
| *Nyctanassa violacea*: Yellow-crowned Night Heron* | U | U | U | | Sh,M | + |
| *Botaurus lentiginosus*: American Bittern | U | | U | R | M | 0 |
| Ciconiidae | | | | | | |
| *Mycteria americana*: Wood Ibis | | U | U | | Sh,M | + |
| Threskiornithidae | | | | | | |
| *Eudocimus albus*: White Ibis | | R | R | | Sh,M | + |
| *Ajaia ajaja*: Roseate Spoonbill | | R | R | | Sh,M | + |
| Anatidae | | | | | | |
| *Olor columbianus*: Whistling Swan | | | | R | W | 0 |
| *Branta canadensis*: Canada Goose | C | | C | | W,O | + |

| | | | | | | |
|---|---|---|---|---|---|---|
| _Anser albifrons_: White-fronted Goose | R | | R | | W,O | + |
| _Chen hyperborea_: Snow Goose | C | | C | U | W,O | + |
| _Chen caerulescens_: Blue Goose | A | | A | C | W,O. | + |
| _Anas platyrhynchos_: Common Mallard* | C | R | C | C | W,M | + |
| _Anas rubripes_: Black Duck | | | | R | W | + |
| _Anas strepera_: Gadwell | A | | A | C | W,M | + |
| _Mareca americana_: Baldpate | A | | A | C | W,M | + |
| _Anas acuta_: Pintail | A | | A | C | W,M | + |
| _Anas carolinensis_: Green-winged Teal | A | | A | C | W,M | + |
| _Anas discors_: Blue-winged Teal* | A | R | A | | W,M | + |
| _Anas cyanoptera_: Cinnamon Teal | R | | R | | W,M | + |
| _Spatula clypeata_: Shoveler | C | | C | U | W,M | + |
| _Ais sponsa_: Wood Duck* | C | U | C | C | W,M | + |
| _Aythya americana_ Redhead | U | | U | U | W | + |
| _Aythya collaris_: Ring-necked Duck | A | | A | C | W | + |

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|---|---|---|---|---|---|---|
| *Aythya valisineria*: Canvasback | U | | U | U | W | + |
| *Aythya marila*: Greater Scaup | R | | R | | W | 0 |
| *Aythya affinis*: Lesser Scaup | A | | A | C | W | + |
| *Bucephala clangula*: American Goldeneye | R | | R | R | W | + |
| *Bucephala albeola*: Bufflehead | U | | U | R | W | + |
| *Clangula hyemalis*: Oldsquaw | | | | R | W | + |
| *Oxyura Jamaicensis*: Ruddy Duck | C | | C | U | W | + |
| *Lophodytes cucullatus*: Hooded Merganser | U | | U | U | W | + |
| *Mergus merganser*: American Merganser | R | | R | | W | + |
| *Mergus serrator*: Red-breasted Merganser | R | | R | | W | + |
| Catharlidae | | | | | | |
| *Cathartes aura*: Turkey Vulture* | A | A | A | A | O,Wd | 0 |
| *Coragyps atratus*: Black Vulture* | C | C | C | C | O,Wd | 0 |

Accipitridae

| | | | | | | |
|---|---|---|---|---|---|---|
| *Ictinia Misisippiensis*: Mississippi Kite | U | | U | | O | 0 |
| *Accipiter striatus*: Sharp-shinned Hawk | U | | U | R | Wd,F | - |
| *Accipiter cooperi*: Cooper Hawk | U | R | U | R | Wd,F | - |
| *Butea Jamaicensis*: Red-tailed Hawk* | U | U | U | C | O,Wd | 0 |
| *Butea harlani*: Harlan Hawk | | | | R | O,Wd | 0 |
| *Buteo lineatus*: Red-shouldered Hawk* | C | C | C | C | Wd, F | - |
| *Buteo platypterus*: Broad-winged Hawk* | C | U | C | | O,Wd | 0 |
| *Buteo swainsoni*: Swainson Hawk | | | R | | O | 0 |
| *Buteo lagopus*: American Rough-legged Hawk | | | | R | O | 0 |
| *Buteo regalis*: Ferruginous Hawk | | | | R | O | 0 |
| *Parabuteo unicinctus*: Harris Hawk | | R | U | | O | 0 |
| *Aquila chrysaetos*: Golden Eagle | R | | R | R | O | 0 |
| *Haliaeetus leucocephalus*: Bald Eagle | R | | R | R | Sh,W | + |
| *Circus cyaneus*: Marsh Hawk | U | | U | U | O,M | 0 |

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|---|---|---|---|---|---|---|
| Pandionidae | | | | | | |
| *Pandion haliaetus*: Osprey | R | | R | | Sh,W | + |
| Falconidae | | | | | | |
| *Polyborus cheriway*: Audubon Caracara | R | R | R | R | O | 0 |
| *Falco mexicanus*: Prairie Falcon | R | R | R | R | O | 0 |
| *Falco peregrinus*: Peregrine Falcon(?) | R | | R | | Sh,O | 0 |
| *Falco columbarius*: Pigeon Hawn | R | | R | | Sh,O | 0 |
| *Falco tinnunculus*: Kestrel* | C | U | C | C | O | 0 |
| Phasianidae | | | | | | |
| *Colinus virginianus*: Bobwhite* | C | C | C | C | Th,Wd | - |
| Gruidae | | | | | | |
| *Grus canadensis*: Sandhill Crane | R | | R | | O | 0 |
| Rallidae | | | | | | |
| *Rallus elegans*: King Rail | R | R | R | R | M | 0 |
| *Rallus limicola*: Virginia Rail | R | | R | | M | 0 |
| *Porzana carolina*: Sora | U | | U | R | M | 0 |

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|---|---|---|---|---|---|---|
| *Coturnicops noveboracensis*: Yellow Rail | | | | R | M,O | 0 |
| *Laterallus jamaicensis*: Black Rail | R | | R | | M,O | 0 |
| *Porphyrula martinica*: Purple Gallinule* | | R | | | M | - |
| *Gallinula chloropus*: Florida Gallinule* | | R | | | M | 0 |
| *Fulica americana*: American Coot | A | U | A | C | M,W | + |
| Charadriidae | | | | | | |
| *Charadrius semipalmatus*: Semipalmated Plover | U | | U | | Sh | + |
| *Charadrius vociferus*: Killdeer* | C | C | C | A | O,Sh | + |
| *Pluvialis dominica*: Golden Plover | U | | R | | O | 0 |
| *Squatarola squatarola*: Black-bellied Plover | U | | U | | Sh | + |
| *Anernaria interpres*: Ruddy Turnstone | R | | R | | Sh | 0 |
| Scolopacidae | | | | | | |
| *Philohela minor*: American Woodcock | | | U | U | F,M | - |
| *Capella gallinago*: Wilson Snipe | C | | C | U | Sh,M | 0 |

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|---|---|---|---|---|
| *Bartramia longicauda*: Upland Plover | U | U | O | O |
| *Actitis macularia*: Spotted Sandpiper | C | C U | Sh,M | + |
| *Tringa solitaria*: Solitary Sandpiper | U | U | Sh,M | O |
| *Catoptrophorus semipalmatus*: Willet | R | R | Sh | + |
| *Totanus melanoleucus*: Greater Yellowlegs | C | C | Sh | + |
| *Totanus flavipes*: Lesser Yellowlegs | C | C | Sh | + |
| *Erolia melanotos*: Pectoral Sandpiper | C | C | O,Sh | + |
| *Erolia fuscicollis*: White-rumped Sandpiper | R | R | Sh | + |
| *Erolia bairdi*: Baird Sandpiper | R | R | Sh | + |
| *Erolia minutilla*: Least Sandpiper | C | C R | Sh | + |
| *Limnodromus griseus*: Short-billed Dowitcher | R | R | Sh | + |
| *Limnodromus scolopaceus*: Long-billed Dowitcher | U | U | Sh | + |

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|---|---|---|---|---|---|
| *Micropalama himantopus*: Stilt Sandpiper | U | U | | Sh | + |
| *Ereunetes pusillus*: Semipalmated Sandpiper | C | C | | Sh | + |
| *Ereunetes mauri*: Western Sandpiper | U | U | | Sh | + |
| *Tryngites subruficollis*: Buff-breasted Sandpiper | R | R | | O | 0 |
| *Limosa fedoa*: Marbled Godwit | R | | | Sh | + |
| *Limosa haemastica*: Hudsonian Godwit | R | R | | M,Sh | + |
| *Crocethia alba*: Sanderling | R | R | | Sh | + |
| Recurvirostridaae | | | | | |
| *Recurvirostra americana*: Avocet | R | R | | Sh | + |
| Phalaropodidae | | | | | |
| *Steganopus tricolor*: Wilson Phalarope | U | R | | Sh | + |
| Laridae | | | | | |
| *Larus argentatus*: Herring Gull | U | U | R | W | + |
| *Larus delawarensis*: Ring-billed Gull | C | C | U | W | + |

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|---|---|---|---|---|---|---|
| *Larus atricilla*: Laughing Gull | R | | R | R | W | + |
| *Larus pipixcan*: Franklin Gull | C | | A | | W | + |
| *Larus philadelphia*: Bonaparte Gull | U | | U | R | W | + |
| *Sterna forsteri*: Forster Tern | U | | C | | W | + |
| *Sterna hirundo*: Common Tern | R | | R | | W | + |
| *Sterna albifrons*: Least Tern | | R | | | W | + |
| *Chlidonias nigra*: Black Tern | U | | U | | W | + |
| Columbidae | | | | | | |
| *Zenaidura macroura*: Mourning Dove* | A | A | A | A | O,Th | 0 |
| Cuculidae | | | | | | |
| *Coccyzus americanus*: Yellow-billed Cuckoo* | C | C | U | | Wd,F | - |
| *Coccyzus erythropthalmus*: Black-billed Cuckoo | R | R | R | | Wd,F | - |
| *Geococcyx californianus*: Roadrunner* | U | U | U | U | Wd,Th | - |

Strigidae

| | | | | | | |
|---|---|---|---|---|---|---|
| _Tyto alba_: Barn Owl* | R | R | R | R | Wd,O | 0 |
| _Otus asio_: Screech Owl* | C | C | C | C | Wd,F | - |
| _Bubo virginianus_: Horned Owl* | U | U | U | U | Wd,F | - |
| _Speotyto cunicularia_: Burrowing Owl | | | | R | O | 0 |
| _Strix varia_: Barred Owl* | C | C | C | C | Wd,F | - |
| _Asio flammeus_: Short-eared Owl | | | | R | O,M | 0 |

Caprimulgidae

| | | | | | | |
|---|---|---|---|---|---|---|
| _Caprimulgus carolinensis_: Chuckwills-widow* | U | C | U | | F,Wd | - |
| _Caprimulgus vociferus_: Whippoorwill | R | | R | | F,Wd | - |
| _Chordeiles minor_: Nighthawk* | U | U | | | O | 0 |

Apodidae

| | | | | | | |
|---|---|---|---|---|---|---|
| _Chaetura pelagica_: Chimney Swift* | A | A | C | | O | 0 |

Trochilidae

| | | | | | | |
|---|---|---|---|---|---|---|
| _Archilochus colubris_: Ruby-throated Hummingbird* | C | U | U | | Wd,T | 0 |

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|---|---|---|---|---|---|---|
| *Archilochus alexandri*: Black-chinned Hummingbird* | U | U | U | | Sh,T | 0 |
| Alcedinidae | | | | | | |
| *Megaceryle alcyon*: Eastern Belted Kingfisher* | C | C | C | C | Sh,W | 0 |
| Picidae | | | | | | |
| *Colaptes auratus*: Yellow-shafted Flicker* | C | U | C | C | Wd,T | - |
| *Colaptes cafer*: Red-shafted Flicker | | | | U | F,Wd | - |
| *Dryocopus pileatus*: Pileated Woodpecker* | U | U | U | U | F,Wd | - |
| *Centurus carolinus*: Red-bellied Woodpecker* | C | C | C | C | F,Wd | - |
| *Centurus aurifrons*: Golden-fronted Woodpecker* | U | U | U | U | F,Wd | - |
| *Melanerpes erythrocephalus*: Red-headed Woodpecker* | C | C | C | C | Wd,T | 0 |
| *Sphyrapicus varius*: Yellow-bellied Sapsucker | C | | C | C | F,Wd | - |
| *Dendrocopos villosus*: Hairy Woodpecker* | U | U | U | U | F,Wd | - |

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|---|---|---|---|---|---|---|
| Dendrocopos pubescens: Downy Woodpecker* | C | C | C | C | F,Wd | - |
| Tyrannidae | | | | | | |
| Tyrannus tyrranus: Eastern Kingbird* | C | C | U | | O,T | O |
| Tyrannus verticalis: Western Kingbird* | U | U | C | | O | O |
| Muscivora forficata: Scissor-tailed Flycatcher* | C | C | A | | O | O |
| Myiarchus crinitus: Northern Crested Flycatcher* | C | U | U | | F,Wd | - |
| Myiarchus cinerascens: Ash-throated Flycatcher | | R | | | O,Sh | O |
| Sayornis phoebe: Eastern Phoebe* | C | R | C | C | Wd,Sh | O |
| Sayornis saya: Say Phoebe | R | | R | | Wd,F | - |
| Empidonax flaviventris: Yellow-bellied Flycatcher | R | | R | | Wd,F | - |
| Empidonax minimus: Least Flycatcher | R | | R | | Th | - |
| Contopus virens: Eastern Wood Pewee* | C | C | C | | Wd,F | - |
| Nuttallornis borealis: Olive-sided Flycatcher | R | | R | | Wd,F | - |

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|---|---|---|---|---|---|---|
| Alaudidae | | | | | | |
| *Eremophila alpestris*: Horned Lark | R | | R | R | O | 0 |
| Hirundinidae | | | | | | |
| *Iridoprocne bicolor*: Tree Swallow | R | | R | | W,Wd | - |
| *Riparia riparia*: Bank Swallow | U | R | U | | O,W | 0 |
| *Stelgidopteryx ruficollis*: Rough-winged Swallow* | C | U | C | | O,W | 0 |
| *Hirundo rustica*: Barn Swallow* | A | U | A | | O,W | 0 |
| *Petrochelidon pyrrhonota*: Cliff Swallow | R | R | R | | O,W | 0 |
| *Progne subis*: Purple Martin* | A | A | C | | O,W | 0 |
| Corvidae | | | | | | |
| *Cyanocitta cristata*: Blue Jay* | C | C | C | C | F,Wd,T | - |
| *Corvus brachyrhynchos*: Crow* | A | A | A | A | F,Wd,O | - |
| Paridae | | | | | | |
| *Parus carolinensis*: Carolina Chickadee* | C | C | C | C | F,Wd | - |
| *Parus bicolor*: Tufted Titmouse* | C | C | C | C | F,Wd | - |

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|---|---|---|---|---|---|---|
| Sittidae | | | | | | |
| *Sitta carolinensis*: White-breasted Nuthatch* | U | U | U | U | F,Wd | - |
| *Sitta canadensis*: Red-breasted Nuthatch | | | | R | Wd | 0 |
| Certhiidae | | | | | | |
| *Certhia familiaris*: Brown Creeper | U | | U | U | F,Wd | - |
| Troglodytidae | | | | | | |
| *Troglodytes aedon*: House Wren | U | | C | R | Th | 0 |
| *Troglodytes troglodytes*: Winter Wren | R | | R | R | F,Th | - |
| *Thryomanes bewicki*: Bewick Wren | U | R | U | U | Th,Wd | - |
| *Thryothorus ludovicianus*: Carolina Wren* | C | C | C | C | F,Th | - |
| *Telmatodytes palustris*: Marsh Wren | U | | R | | M | 0 |
| Mimidae | | | | | | |
| *Mimus polyglottos*: Mockingbird* | C | C | C | C | Th,T | 0 |
| *Dumetella carolinensis*: Catbird* | U | R | R | | Th, T | 0 |
| *Toxostoma rufum*: Brown Thrasher* | C | U | C | C | Th,T | 0 |

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|---|---|---|---|---|---|---|
| Turdidae | | | | | | |
| Turdus migratorius: Robin* | C | U | C | A | T,O | 0 |
| Hylocichla mustelina: Wood Thrush* | U | U | R | | F,Wd | - |
| Hylocichla guttata: Hermit Thrush | C | | U | U | F,Wd | - |
| Hylocichla ustulata: Swainson Thrush | U | | R | | F,Wd | - |
| Hylocichla minima: Gray-cheeked Thrush | U | | R | | F,Wd | - |
| Sialia sialis: Eastern Bluebird* | C | C | C | A | T,O | 0 |
| Sylviidae | | | | | | |
| Polioptila caerulea: Blue-gray Gnatcatcher* | C | C | C | | F,Wd | - |
| Regulus satrapa: Golden-crowned Kinglet | C | | C | C | F,Wd | - |
| Regulus calendula: Ruby-crowned Kinglet | C | | C | C | F,Wd | - |
| Motacillidae | | | | | | |
| Anthus spinoletta: American Pipit | U | | C | U | O,Sh | 0 |
| Anthus spraguei: Sprague Pipit | R | | R | R | O | 0 |

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|---|---|---|---|---|---|---|
| Bombycillidae | | | | | | |
| *Bombycilla cedrorum*: Cedar Waxwing | A | | C | A | T,F | 0 |
| Laniidae | | | | | | |
| *Lanius ludovicianus*: Migrant Shrike* | C | U | C | C | O | 0 |
| Sturnidae | | | | | | |
| *Sturnus vulgaris*: Starling* | A | A | A | A | T,O | 0 |
| Vireonidae | | | | | | |
| *Vireo griseus*: White-eyed Vireo* | C | C | U | | Th | 0 |
| *Vireo belli*: Bell Vireo | R | R | | | Th | 0 |
| *Vireo solitarius*: Solitary Vireo | U | | U | | F,Wd | - |
| *Vireo flavifrons*: Yellow-throated Vireo | R | | R | | F,Wd | - |
| *Vireo olivaceus*: Red-eyed Vireo* | C | C | U | | F,Wd | - |
| *Vireo philadelphicus*: Philadelphia Vireo | U | | R | | F,Wd | - |
| *Vireo gilvus*: Warbling Vireo | U | R | R | | F,Sh | - |

Parulidae

| | | | | | | |
|---|---|---|---|---|---|---|
| _Mniotilta varia_: Black-and-white Warbler* | C | U | C | | F,Wd | - |
| _Protonotaria citrea_: Prothonotary Warbler* | U | U | R | | F,Sh | - |
| _Vermivora peregrina_: Tennessee Warbler | R | | R | | F,Sh | - |
| _Vermivora celata_: Orange-crowned Warbler | U | U | U | R | Sh | - |
| _Vermivora ruficapilla_: Nashville Warbler | C | | U | | F,Wd | - |
| _Parula americana_: Parula Warbler* | C | C | U | | F | - |
| _Dendroica petechia_: Yellow Warbler | U | | R | | Th,M | 0 |
| _Dendroica magnolia_: Magnolia Warbler | C | | R | | F,Wd | - |
| _Dendroica Tigrina_: Cape May Warbler | R | | R | | Sh | 0 |
| _Dendroica coronata_: Myrtle Warbler | U | | U | C | F,Wd | - |
| _Dendroica nigrescens_: Black-throated Green Warbler | U | | R | | F,Wd | - |

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|---|---|---|---|---|---|---|
| *Dendroica cerulea*: Cerulean Warbler | R | | | | F,Wd | - |
| *Dendroica fusca*: Blackburnian Warbler | U | | R | | F,Wd | - |
| *Dendroica dominica*: Yellow-throated Warbler* | U | R | | | F,Wd | - |
| *Dendroica pensylvanica*: Chestnut-sided Warbler | C | | R | | F,Th | - |
| *Dendroica castanea*: Bay-breasted Warbler | U | | R | | F,Wd | - |
| *Seiurus autocapillus*: Ovenbird | R | | R | | Wd,F | - |
| *Seiurus noveboracensis*: Water-thrush | R | | R | | Sh,M | 0 |
| *Oporornis formosus*: Kentucky Warbler* | U | U | | | F,Wd | - |
| *Oporornis agilis*: Connecticut Warbler | R | | | | F,Th | - |
| *Oporornis philadelphia*: Mourning Warbler | R | | R | | F,Th | - |
| *Geothlypis trichas*: Yellowthroat* | C | C | U | R | M,Th | 0 |
| *Icteria virens*: Yellow-breasted Chat* | C | C | U | | Th | 0 |

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|---|---|---|---|---|---|---|
| *Wilsonia pusilla*: Wilson Warbler* | R | R | | | F | - |
| *Wilsonia canadensis*: Canada Warbler | U | | R | | F | - |
| *Setophaga ruticilla*: Redstart | U | | R | | F,Wd | - |
| Ploceidae | | | | | | |
| *Passer domesticus*: English Sparrow | A | A | A | A | T,O | 0 |
| Icteridae | | | | | | |
| *Dolichonyx oryzivorus*: Bobolink | U | | U | | O,M | 0 |
| *Sturnella magna*: Eastern Meadowlark* | A | A | A | A | O | 0 |
| *Xanthocephalus xanthocephalus*: Yellow-headed Blackbird | R | | R | | M,O | + |
| *Agelaius phoeniceus*: Redwing Blackbird* | A | A | A | A | M,O | 0 |
| *Icterus spurius*: Orchard Oriole* | C | C | R | | Th | 0 |
| *Icterus galbula*: Baltimore Oriole* | U | R | R | | T | 0 |
| *Icterus bullocki*: Bullock Oriole | R | | R | | F | - |

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|---|---|---|---|---|---|---|
| *Euphagus carolinus*: Rusty Blackbird | U | | | C | F,T,O | - |
| *Euphagus cyanocephalus*: Brewer Blackbird | | | | A | O | 0 |
| *Quiscalus quiscula*: Grackle* | A | U | C | A | T,Th | 0 |
| *Molothrus ater*: Cowbird* | A | A | A | A | O,T | 0 |
| Thraupidae | | | | | | |
| *Piranga olivacea*: Scarlet Tanager | R | | | | F,Wd | - |
| *Piranga rubra*: Summer Tanager* | C | C | U | | F,Wd | - |
| Fringillidae | | | | | | |
| *Richmondena cardinalis*: Cardinal* | A | A | A | A | Wd,Th | - |
| *Pheucticus ludovicianus*: Rose-breasted Grosbeak | U | | R | | F,T | - |
| *Guiraca caerulea*: Blue Grosbeak* | C | C | U | | Th | 0 |
| *Passerina cyanea*: Indigo Bunting* | C | C | C | | Th | 0 |
| *Passerina ciris*: Painted Bunting* | C | C | U | | Th | 0 |
| *Spiza americana*: Dickcissel* | C | C | U | | O | 0 |

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|---|---|---|---|---|---|---|
| *Carpodacus purpureus*: Purple Finch | C | | | C | F,Wd | - |
| *Spinus pinus*: Northern Pine Siskin | C | | | C | Wd,Th | 0 |
| *Spinus tristis*: Goldfinch | A | | C | A | Wd,Th | 0 |
| *Pipilo erythrophthalmus* Rufous-sided Towhee | U | | U | U | F,Wd,Th | - |
| *Passerculus sandwichensis*: Savannah Sparrow | C | | C | C | O,Th | 0 |
| *Ammodramus savannarum*: Grasshopper Sparrow* | U | R | R | | O | 0 |
| *Ammodramus bairdi*: Baird Sparrow | | | | U | O | 0 |
| *Passerherbulus caudacutus*: Leconte Sparrow | U | | U | U | Th,O | 0 |
| *Passerherbulus henslowi*: Henslow Sparrow | | | | U | O | 0 |
| *Pooecetes gramineus*: Vesper Sparrow | C | | U | C | Th,O | 0 |
| *Chondestes grammacus*: Lark Sparrow* | C | C | C | C | O,Th | 0 |
| *Aimophila aestivalis*: Bachman Sparrow | U | U | U | U | Wd,Th | - |
| *Junco hyemalis*: Slate-colored Junco | C | | C | A | Th,Wd | 0 |
| *Spizella arborea*: Tree Sparrow | | | | R | O | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Spizella passerina*: Chipping Sparrow* | U | R | U | R | Wd,Th | 0 |
| *Spizella pallida*: Clay-colored Sparrow | R | | | | Th,T | 0 |
| *Spizella pusilla*: Field Sparrow* | C | C | C | C | Th | 0 |
| *Zonotrichia querula*: Harris Sparrow | U | | | C | Th | 0 |
| *Zonotrichia leucophrys*: White-crowned Sparrow | U | | U | C | Th | 0 |
| *Zonotrichia albicollis*: White-throated Sparrow | C | | C | A | F,Wd,Th | - |
| *Passerella iliaca*: Fox Sparrow | U | | U | U | F,Th | - |
| *Melospiza lincolni*: Lincoln Sparrow | C | | C | U | Th | 0 |
| *Melospiza georgiana*: Swamp Sparrow | U | | U | U | M,Th | 0 |
| *Melospiza melodia*: Song Sparrow | U | | U | C | Th,M | 0 |

*Species known to breed in the area

a: Occurrence classifications:
A - abundant
C - common
U - uncommon
R - rare

b: Preferred habitat classifications:
- F - bottomland hardwood forest
- M - marshes and swamps
- O - fields, pastures, croplands
- Sh - lake and stream shores
- T - towns, parks, dwellings and scattered trees
- Th - thickets and scrubby woodland edges
- W - open water
- Wd - dry woodland

c: Predicted short-term changes:
- \+ population increase
- \- population decrease
- 0 no change predicted

Of fifty species of birds that are reported as abundant or common in the vicinity of the Aquilla Creek project forty-six were observed during the summer of 1972. Of these, fifteen species are found primarily in heavily wooded stream bottoms. The wooded edges of Aquilla, Hackberry, and Cobb Creeks represent a substantial portion of the total of this type of habitat found in Hill County.

Therefore, those species that would suffer a serious reduction in quantity of habitat are: Red-shouldered hawk, Bobwhite, Yellow-billed cuckoo, Barred owl, Chuckwillswidow, Red-bellied woodpecker, Downy woodpecker, Eastern wood pewee, Blue jay, Chickadee, Tufted titmouse, Carolina wren, Blue-gray gnatcatcher, Red-eyed vireo, Parula warbler, Summer tanager, and Cardinal.

A dam installation across the Aquilla Creek basin would provide an increase in favorable habitat for water, shore, and marsh-dwelling birds. Many of these are migratory, and another reservoir near the eastern edge of the "Central Flyway" might serve in their migratory and wintering activities. Among the birds that would benefit from such a reservoir are: Loons, Grebes, Pelicans, Cormorants, Water turkeys, Herons and Egrets, Ibises, Spoonbills, several species of Geese, several species of Ducks, Mergansers, Bald eagles, Ospreys, Coots, Plovers and Killdeers, Sandpipers, Yellowlegs,

Dowitchers, Godwits, Avocets, Phalaropes, Gulls, Terns and Yellow-headed blackbirds. The names of two of these species appear on endangered species lists: Bald eagle and Osprey.

## REPTILES AND AMPHIBIANS OF THE AQUILLA CREEK BASIN

### Amphibia

| Species | Common Name | Preferred Habitat[a] | Effect on Population[b] |
|---|---|---|---|
| Order Caudata | | | |
| Sirenidae | | | |
| *Siren intermedia* | Lesser Siren | FW | - |
| Ambystomatidae | | | |
| *Ambystoma texanum* | Small-mouthed Salamander | Wd | - |
| *Ambystoma tigrinum* | Tiger Salamander | Wd | - |
| Salamandridae | | | |
| *Notophthalmus viridescens* | Common Neut | Wd | - |
| Order Aniina | | | |
| Pelobatidae | | | |
| *Scaphiopus couchi* | Couch's Spadefoot | V | 0 |
| *Scaphiopus holbrooki* | Eastern Spadefoot | V | 0 |
| Hylidae | | | |
| *Acris crepitans* | Cricket Frog | Sh | + |
| *Hyla cinerea* | Green Tree Frog | Wd | - |
| *Hyla chrysoscelis* | Gray Tree Frog | Wd | - |
| *Pseudacris clarki* | Chorus Frog | Wd | - |
| *Pseudacris streckeri* | Strecker Chorus Frog | Wd | - |
| *Pseudacris triseriata* | Western Chorus Frog | Wd | - |

| | | | |
|---|---|---|---|
| Bufonidae | | | |
| _Bufo debilis_ | Green Toad | V | 0 |
| _Bufo punctatus_ | Red-spotted Toad | V | 0 |
| _Bufo speciosus_ | Texas Toad | V | 0 |
| _Bufo valliceps_ | Gulf Coast Toad | V | 0 |
| _Bufo woodhousei_ | Woodhouse Toad | V | 0 |
| Ranidae | | | |
| _Rana catesbeiana_ | Bullfrog | Sh | + |
| _Rana pipiens_ | Grass Frog | V | 0 |
| Microhylidae | | | |
| _Gastrophryne carolinensis_ | Eastern Narrow-mouthed Toad | V | 0 |
| _Gastrophryne olivacea_ | Great Plains Narrow-mouthed Toad | V | 0 |

## _Reptilia_

Order Testudinata

| | | | |
|---|---|---|---|
| Chelydridae | | | |
| _Chelydra serpentina_ | Snapping Turtle | Sh | + |
| Kinosternidae | | | |
| _Kinosternon flavescens_ | Yellow Mud Turtle | Sh | + |
| _Stenothaerus odoratus_ | Stinkpot | Sh | + |
| Emydidae | | | |
| _Chrysemys concinna_ | River Cooter | FW | - |
| _Chrysemys scripta_: | Pond Slider | Sh | + |
| _Deirochelys reticulata_ | Chicken Turtle | Sh | + |
| _Graptemys pseudogeographica_ | False Map Turtle | Sh | + |
| _Terrapene carolina_ | Eastern Box Turtle | V | 0 |
| _Terrapene ornata_ | Ornate Box Turtle | V | 0 |

| | | | |
|---|---|---|---|
| Trionychidae | | | |
| *Trionyx muticus* | Smooth Softshell | FW | - |
| *Trionyx spiniferous* | Spiny Softshell | FW | - |
| Order Squamata | | | |
| Iguanidae | | | |
| *Anolis carolinensis* | Green Anole | Wd | - |
| *Cophosaurus texanus* | Greater Earless Lizard | V | 0 |
| *Crotaphytus collaris* | Collared Lizard | V | 0 |
| *Hoolbrokia maculata* | Lesser Earless Lizard | V | 0 |
| *Phrynosoma cornutum* | Texas Horned Lizard | V | 0 |
| *Sceloporus olivaceous* | Texas Spiny Lizard | V | 0 |
| *Scelopous undulatus* | Fence Lizard | V | 0 |
| Scincidae | | | |
| *Eumeces fasciatus* | Five-lined Skink | Wd | - |
| *Eumeces latriceps* | Broad-headed Skink | Wd | - |
| *Eumeces obsoletus* | Great Plains Skink | V | 0 |
| *Eumeces septentrionalis* | Prairie Skink | Wd | - |
| *Lygosoma laterale* | Ground Skink | Wd | - |
| Teiidae | | | |
| *Cnemidophorus gularis* | Texas Spotted Whiptail | V | 0 |
| *Cnemidophorus sexlineatus* | Six-lined Racerunner | V | 0 |
| Anguidae | | | |
| *Ophisaurus attenuatus* | Slender Glass Lizard | V | 0 |

| | | | |
|---|---|---|---|
| Colubridae | | | |
| *Coluber constrictor* | Racer | | |
| *Diadophis punctatus* | Ringneck Snake | Wd | - |
| *Elaphe guttata* | Corn Snake | V | 0 |
| *Elaphe obsoleta* | Common Rat Snake | V | 0 |
| *Heterodon platyrhinos* | Eastern Hognose Snake | V | 0 |
| *Hypsiglena torquata* | Night Snake | V | 0 |
| *Lampropeltis calligaster* | Prairie Kingsnake | V | 0 |
| *Lampropeltis getulis* | Common Kingsnake | V | 0 |
| *Masticophis flagellum* | Coachwhip | Wd | - |
| *Natrix erythrogaster* | Plain-bellied Water Snake | Sh | + |
| *Natrix fasciata* | Broad-banded Water Snake | Sh | + |
| *Natrix grahami* | Graham Water Snake | Sh | + |
| *Natrix rhombifera* | Diamond-backed Water Snake | Sh | + |
| *Opheodrys aestivus* | Rough Green Snake | Wd | - |
| *Pithuophis melanoleucus* | Bullsnake | V | 0 |
| *Sonora episcopa* | Great Plains Ground Snake | V | 0 |
| *Storeria dekayi* | Brown Snake | Wd | - |
| *Tantilla gracalis* | Flat-headed Snake | Wd | - |
| *Thamnophis marcianus* | Checkered Garter Snake | Sh | + |
| *Thamnophis proximus* | Western Ribbon Snake | V | 0 |
| *Thamnophis sirtalis* | Common Garter Snake | Sh | + |
| *Tropidodonion lineatum* | Lined Snake | V | 0 |
| *Virginia striatula* | Rough Earth Snake | V | 0 |

| | | | |
|---|---|---|---|
| Blapidae | | | |
| Micrurus fulvius | Coral Snake | Wd | - |
| Viperidae | | | |
| Agkristrodon contortrix | Copperhead | Wd | - |
| Agkristrodon piscivorus | Cottonmouth | Sh | + |
| Sistrunus catenatus | Massasauga | Sh | + |
| Crotalus atrox | Western Diamondback Rattlesnake | V | 0 |
| Crotalus horridus | Timber Rattlesnake | Wd | - |

a: Preferred Habitat
Wd - bottomland forest floor
FW - flowing water
Sh - shore and shallow water
V - variety of habitats or upland

b: Effect of impoundment on population
\+ population increase
\- population decrease
0 no change predicted

The tailed amphibians that inhabit the Aquilla Creek area that will be adversely affected are primarily those that are found in association with flood plains woodland. However, none of the species that fall in this category are endemics; all of them enjoy a rather wide range. The lesser siren, a flowing water species, will be removed from the inundated portion of the watershed, but its range in Texas includes most of the counties of east and southern Texas. (Raun, 1972).

Most of the tailless amphibians of Hill County would not be adversely affected with the construction of a dam on Aquilla Creek. Exceptions are the small frogs that are found as regular inhabitants of the flood plain wooded areas: Hyla cinerea, Hyla chrysoscelis,

Pseudacris clarki, Pseudacris streckeri, and Pseudacris triseriata. One important game species, Rana catesbeiana, would enjoy a population expansion due to an increase in favorable habitat proffered by the increased shoreline of the proposed reservoir.

Most of the turtles of the area would increase their populations following reservoir construction. Exceptions are those species that are found in flowing water: Chrysemys concinna, Trionyx muticus, Trionyx spiniferous. Most turtles enjoy a niche rather high on aquatic food chains; therefore, an increase in population of a turtle species (e.g., Chelydra serpentina) need not indicate that this would be a favorable occurrence with reference to man's activities. Competition with more favored species would tend to make an increase in overall turtle populations a detrimental effect of an Aquilla Creek impoundment.

These data based on field collections and observations, as well as authenticated records as presented by Raun and Gehlbach (1972).

Lizards that would suffer eradication in the areas of inundation are: Anolis carolinensis, Eumeces fasciatus, Eumeces laticeps, Eumeces septentrionalis, and Lygosoma laterale. None of these are endangered species. Indications are that other species of lizards would not be affected by the proposed habitat change.

No species of snake would be seriously threatened over a substantial portion of its range by the proposed reservoir. One species, however, that is dangerous to man would be encouraged along the shoreline of a proposed reservoir. This species is Agkristrodon piscivorus, the cottonmouth.

Records of reptiles and amphibians are rather sketchy for Hill County, Texas. In addition to this, collections during the summer of 1972 were not too productive. (All together 24 species were seen or collected during this collection period.) Records for the county and adjoining counties were taken primarily from Raun (1972).

## MAMMALS OF THE AQUILLA CREEK BASIN

The mammals of the Aquilla Creek basin are typical of the eastern portion of the Texan biotic province (Blair, 1950). No species are included in the area that are endemics. Also, there were no species among the thirty-eight known to inhabit the area that are considered to be in danger of extinction.

Literature records are not abundant for mammals of Hill County, Texas. Therefore, records of species present were primarily based upon the investigations of Davis (1966), comparative specimens and records of the Dallas Museum of Natural History, and field investigations. Field investigations involved general reconaissance of the area (day and night), observations of the animals present by sight, if possible, or sign, if the signs were definite enough. Personal interviews with inhabitants of the area also yielded certain pertinent data. Also included in the field investigations were 285 trap nights using medium Sherman live traps and a variety of baits. The live trapping yielded twenty-five animals; however, the variety taken, even from different habitats, was not great. Relative abundance figures reflect generalities, as abundance for one species may vary greatly from another depending upon secrecy, diurnal or nocturnal habits, size, range, and territory.

Each proposed impoundment would affect most those species that usually inhabit either the creeks or the wooded flood plains central to Aquilla Creek and its tributaries. These species include the o'possum, the armadillo, the fox squirrel, the flying squirrel, the beaver, the white-footed mouse, the Florida wood rate, the nutria, the raccoon, the mink, the gray fox, and the white-tailed deer. Of these species, the fox squirrel, the raccoon, and the deer are considered game species. Mr. O. W. Roten, a rural resident of the area, has seen deer very infrequently in the area. Fox squirrels are more prevalent and hunted under rather light pressure. Raccoon hunting is unusual for the area. Cottontail rabbits have some value as food species.

Mr. Roten also remarked about the abundance of beaver along the main artery of Aquilla Creek. In the past, this species was extensively trapped for its fur value, along with mink, raccoons, o'possums, skunks, gray foxes, and more recently the nutria. Little trapping is currently practiced in the area.

The dominant predators of the area, excepting domestic dogs and cats, are the coyotes and bobcats.

Any of the proposed impoundments for the area would have little or no far-reaching effects on the mammal species present.

| Species | Relative Abundance[a] | Preferred Habitat[b] | Predicted Population Change[c] |
|---|---|---|---|
| Didelphis marsupialis: O'possum | C | F,W,O | - |
| Scalopus aquaticus: Eastern Mole | U | Wd,O | 0 |
| Cryoptotis parva: Little Short-tailed Shrew | U | Gr | 0 |
| Eptesicus fusuc: Big Brown Bat | U | F,H | 0 |
| Lasiurus cinereus: Hoary Bat | R | W | 0 |
| Lasiurus borealis: Red Bat | U | W | 0 |
| Tadaria mexicana: Guano Bat | C | H,Wd,O | 0 |
| Dasypus novenicinctus: Armadillo | A | F,W,O | - |
| Lepus californicus: Black-tailed Jackrabbit | C | Gr | 0 |
| Sylvilagus floridanus: Eastern Cottontail | C | Th,Gr. | 0 |
| Citellus tridecemlineatus: 13-lined Ground Squirrel | R | O,Gr | 0 |
| Sciurus niger: Fox Squirrel | C | Wd,F | - |

| | | | |
|---|---|---|---|
| *Glaucomys volans*: | | | |
| Eastern Flying Squirrel | R | Wd,F | - |
| *Geomys bursarius*: | | | |
| Plains Pocket Gopher | A | O,G | 0 |
| *Perognathus hispidus*: | | | |
| Hispid Pocket Mouse | C | Th,G | 0 |
| *Castor canadensis*: | | | |
| Beaver | C | R,M | - |
| *Reithrodontomys fulvescens*: | | | |
| Long-tailed Harvest Mouse | R | Th,G | 0 |
| *Reithrodontomys montanus*: | | | |
| Gray Harvest Mouse | U | Th,G | 0 |
| *Baiomys taylori*: | | | |
| Pigmy Mouse | R | Gr,Th | 0 |
| *Peromyscus maniculatus*: | | | |
| Deer Mouse | C | Gr,Th | 0 |
| *Peromyscus leucopus*: | | | |
| White-footed Mouse | A | F,R | - |
| *Peromyscus boylii*: | | | |
| Brush Mouse | R | Gr,Th | 0 |
| *Sigmodon hispidus*: | | | |
| Hispid Cotton Rat | C | Gr,Th | 0 |
| *Neotoma floridaua*: | | | |
| Florida Wood Rat | U | F | - |
| *Mus musculus*: | | | |
| House Mouse | A | H,G | - |
| *Rattus rattus*: | | | |
| Roof Rat | A | H | 0 |
| *Rattus norvegicus*: | | | |
| Norway Rat | C | H,Th | 0 |
| *Myocastor coypus*: | | | |
| Nutria | U | R | - |
| *Procyon lotor*: | | | |
| Raccoon | C | R,F | - |
| *Bassariscus astutus*: | | | |
| Ringtail | R | Rk,Th,Wd | 0 |
| *Mustela frenata*: | | | |
| Longtailed Weasel | R | Gr,O | 0 |
| *Mustela wison*: | | | |
| Mink | R | R,F | - |
| *Spilogale Putorius*: | | | |
| Spotted Skunk | U | Wd,G,O | 0 |

| | | | |
|---|---|---|---|
| Mephitis mephitis: | | | |
| Striped Skunk | C | Wd,Th | 0 |
| Vrocyron cinercoar-genteus: | | | |
| Grayfox | C | F,W,Th | - |
| Canis latraus: | | | |
| Coyote | C | Gr,O,Wd | 0 |
| Lynx rufus: | | | |
| Bobcat | U | Rk,Th,Wd | 0 |
| Odocoileus virginianus: | | | |
| White-tailed Deer | R | F,W,O | - |

a: Relative abundance
- A - abundant
- C - common
- U - uncommon
- R - Rare

b: Habitat preferred
- F - forrested bottomland
- Gr - grasslands, meadows, old fields
- H - human habitations
- M - marshes, swamps, sloughs, ponds
- O - open farmland, scattered trees
- R - stream, stream shores
- Rk - rocky areas
- Th - thickets, brush piles
- Wd - dry, upland woods

c: Population change
- + increase
- - decrease
- 0 no predictable change

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Figure 17. Town of Aquilla historic marker.

## RECOMMENDATIONS

Construction of a reservoir or reservoirs within the Aquilla Creek Watershed will improve the natural environment downstream due to a decrease in overbank flooding and erosion. The cleaner water that will result will help to preserve the native creek bank hardwood habitat that is present downstream from the confluence of Hackberry and Aquilla Creeks. In order to preserve this habitat along all creeks within the watershed we recommend that channelization of creeks within the watershed not be considered. It has been shown that channelization tends to increase erosion and consequently siltation and at the same time destroys the natural environment. Neither of these effects are to be desired within the watershed.

We recommend that construction of upstream floodwater retarding structures as outlined in the "Work Plan for Watershed Protection and Flood Prevention: Aquilla-Hackberry Creek Watershed" as prepared by the Soil Conservation Service be implemented so that water flowing into the proposed reservoir(s) will contain less silt than is presently carried. In addition, a decrease in silt load will improve water quality within the reservoir and also downstream. We recommend that large tracts of land within the watershed by converted to grassland pasture. Grass would cut down water runoff and thereby decrease the silt load carried by the streams.

Archaeological sites will be adversely affected by construction of any of the reservoir sites as well as by the upstream floodwater retaining structures. Destruction of these resources represents an irreversible effect upon the cultural resources within the watershed. Therefore, we recommend that an adequate program of site preservation through archaeological salvage excavations be carried out while land purchasing is underway and prior to construction of the reservoir.

## Dam Site Evaluation

### Dam Site A

Creation of a dam and reservoir at this location will have an adverse effect upon the natural environment and the historical resources and is likely to find considerable adverse public reaction. The historic town of Aquilla would be inundated and before this occurred it would be necessary to carry out a detailed historical and archaeological investigation of the entire town site. In addition several historic log cabins would be destroyed. Inundation of Aquilla would also require the relocation of a large number of people and the disruption of an important educational complex within Hill County. For these reasons we feel that public reaction to selection of this dam site would be unfavorable.

A dam placed at Site A would flood almost all of the native hardwood forest belt that is found along the creek banks of Aquilla Creek. This is one of the few natural habitats available within the watershed and should be preserved as such. If Site A was chosen, this would mean that no major streams within the watershed would remain in a natural or native condition.

We recommend that another location be chosen.

### Dam Site B

Construction of a reservoir in this location would 1) require the relocation of the inhabitants of Aquilla, 2) necessitate an intensive historical and archaeological study of the town site of Aquilla, and 3) have an adverse effect upon the hardwood forest habitat. Factors 1 and 2 would probably incur negative response from a large body of the Hill County population. Selection of this dam site would preserve part of the hardwood habitat and would preserve Alligator Creek in its natural condition.

We recommend that this dam site not be selected.

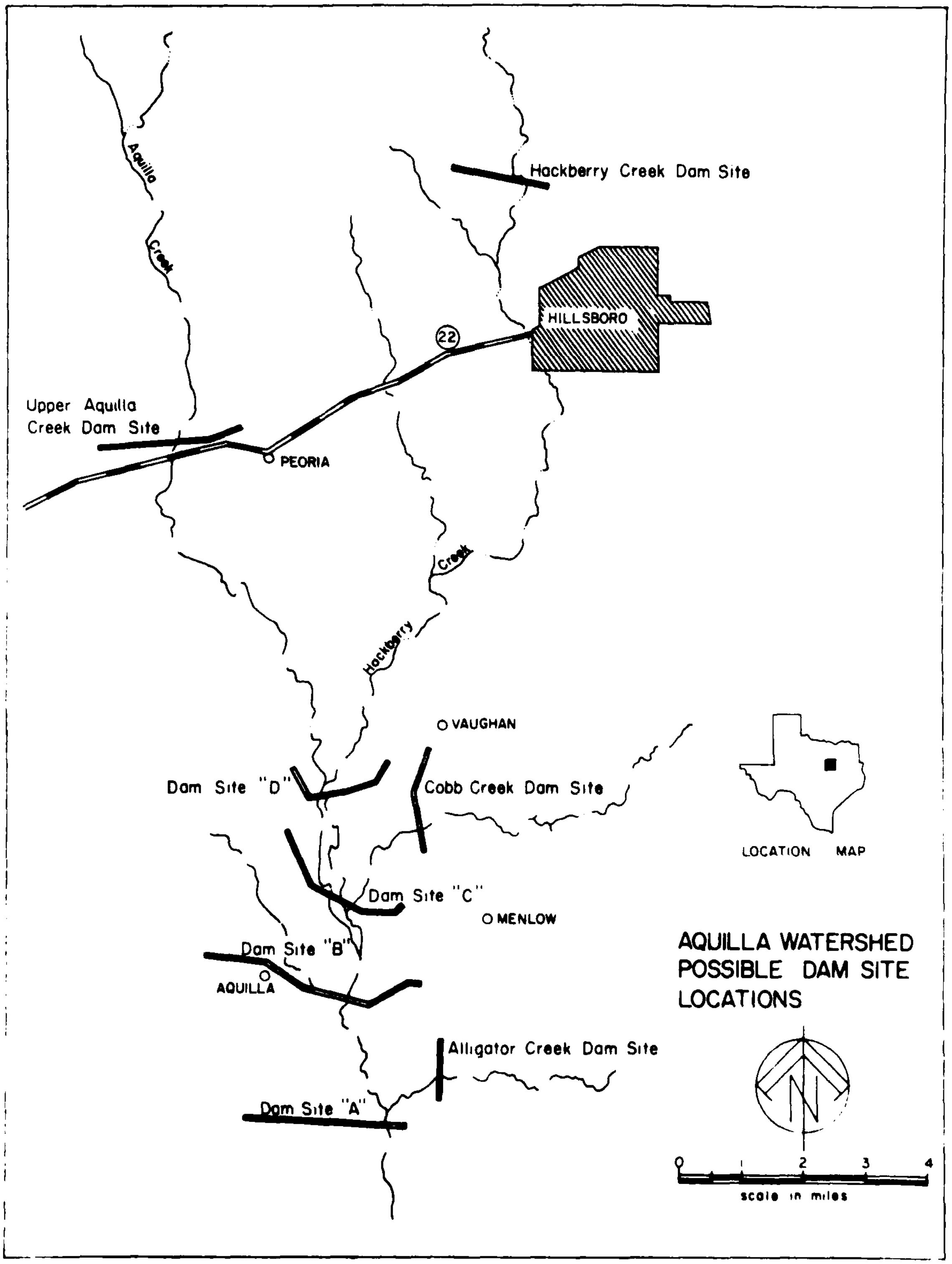


Figure 18. Location of possible dam sites.

Dam Site C

This location was the original choice for the placement of the dam. With regard to dam foundation, potential lake depth and size this still appears to be the favored dam site. Choice of this location will result in an adverse effect upon a section of the hardwood forest belt along Aquilla Creek and destruction of the natural environment of Cobb Creek; Alligator Creek would however be preserved. No important historic resources have been reported in this area and the vast majority of the public is prepared to accept this site.

We tentatively recommend this site as discussed below.

Dam Site D

Construction of a dam at this site will have the least adverse effect of any site on the Aquilla Creek mainstream upon the native hardwood habitat. In addition, choice of Site D would allow Cobb and Alligator Creeks to remain in their native condition. However, we believe that water availability is limited due to the smaller watershed area; therefore, it might be necessary to put a dam on Cobb or Alligator Creeks in order to insure adequate water. In addition additional road relocation might be necessitated.

We recommend that this site be ruled out of consideration unless a smaller reservoir is deemed adequate to meet the desired goals.

Multiple Dam Sites (Upper Aquilla, Hackberry, Cobb and Alligator Creeks)

Selection of this alternative would result in the preservation of the hardwood habitat along Aquilla Creek and in the destruction of the natural habitats of large stretches of each creek. It would necessitate modification of the Soil Conservation Service Work Plan for Aquilla and Hackberry Creeks and would require that additional steps be made to develop and implement a

floodwater control project on Cobb and Alligator Creeks. We anticipate that a larger number of archaeological sites will be affected by these dams than by the single dam sites.

We tentatively recommend this site as discussed below.

It is the recommendation of this report that the Multiple Dam Sites and Dam Site C be given serious consideration. Selection of the Multiple Dam Sites would result in the preservation of the entire length of the Aquilla Creek hardwood habitat while Site C will inundate part of the habitat. However, Dam Site C appears to represent the best structural locality of all the dam sites. At present it is impossible to evaluate the engineering potential of the Multiple Dam Sites since these data are not available.

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8